XXII. NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

XII. Scopimerinae.

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Plates XII, XIII.

This subfamily of Ocypodidae comprises a number of very small crabs found on the sea shore or in estuaries and backwaters. Four genera have hitherto been recognised:—*Scopimera*, de Haan, *Dotilla*, Stimpson (= *Doto*, de Haan), *Ilyoplax*, Stimpson and *Tympanomerus*, Rathbun (= *Dioxippe*, de Man). A fifth is here described under the name *Dotillopsis*.

The range of the subfamily extends from the southern and western coasts of Africa and the Red Sea to the Banda Sea, the Philippine Is. and Japan. Its headquarters appear to be on the Indian coasts on which all the genera except the problematical *Ilyoplax* occur.

Including the new forms here described thirty species of Scopimerinae are now known: of these I have seen twenty-one. Eighteen species are known from the Indian coasts and of these I have seen all but one and the types or paratypes of thirteen.

The Scopimerine crabs are of small size as compared with the Ocypodinae. They are all littoral or estuarine and strictly amphibious in habits. Unlike *Ocypoda* the coastal species live only in sheltered bays on the shores of which surf never breaks. The species of *Dotilla* and *Scopimera* burrow in damp sand between tide-marks and different forms are as a rule restricted to different levels on the beach. For example, both in Mormugao Bay on the west coast of India and at Tuticorin on the south-east coast *Scopimera proxima* and *Dotilla myctiroides* occur, the former inhabiting the zone near high-water mark, while the latter is to be found near low-water mark. *Tympanomerus* burrows in rather stiff clay or muddy sand, while *Dotillopsis* affects estuarine mud of the softest consistency.

All the species construct small oblique burrows, from which they remove the sand or mud in little pellets. This is done as often as the tide sinks and exposes the area in which they are living. In nearly all cases the pellets are disposed with some care, in such a way that one or more pathways are left clear on the surface round the mouth of the burrow. The pathways themselves are smoothed and apparently hollowed out by the crab. The

arrangement of the pellets gives the burrow a very characteristic appearance, enabling it to be distinguished at a glance from that of young *Ocypoda* and other forms of similar habits.

The crabs are gregarious and sometimes occur in very large numbers. Beaches occupied by them can occasionally be recognised at a considerable distance by their freshly raked surface. Little is known as to what occurs in these communities at high tide, but as they are very seldom obtained in nets hauled on suitable ground near the shore it is probable that they remain in their burrows. When the tide is out they may often be seen sitting at the mouths of the burrows or in the pathways leading to them, but seldom if ever wander further afield. Each crab or pair of crabs keeps rigidly to its burrow.

The habits of the Indian species of *Dotillopsis* seem to be somewhat different from those of the other genera because the mud in which it burrows is too soft to retain a definite impression. It is often impossible to distinguish its holes, though it appears to excavate them in the same way. The dense tomentum on the walking legs in this genus and in certain species of *Tympanomerus* is probably an adaptation to life on muddy ground.

Most of the species of *Dotilla* and *Scopimera* live on the sea-shore. A few make their way into backwaters, where the water is brackish or of very variable salinity, but the environment in such situations is as a rule unfavourable. The crabs usually fail to reach their normal size, and in species in which there are marked structural differences between the sexes, the males seem unable to attain their full development.

Most species of *Tympanomerus* are found in estuaries, often near or even beyond the extreme limit of tidal influence. Both species of *Dotillopsis* are essentially estuarine, but the Indian form has been found in a small backwater near the open sea as well as a considerable way up the Gangetic delta. No species has been found at any great distance from the coast, but *T deschampsi* and *T. stapletoni* are able to live on the banks of large rivers at places where the water is always fresh. *T. stapletoni* is said to have destroyed a dynasty of kings in Eastern Bengal by burrowing through the embankments their people had constructed and so letting brackish water in to the rice-fields.

In examining the Indian species of Scopimerinae I have met with instances of dimorphic forms in the female as well as in the male sex. In *Dotilla intermedia* two perfectly distinct types of adult male exist which differ conspicuously in the structure of the first segment of the abdominal sternum and chela and in the form of the copulatory appendage. *Scopimera proxima* presents still more interesting features, for it exhibits dimorphism of the female—a phenomenon not, I think, hitherto noticed in Decapod Crustacea. The dimorphism in this instance is to be found in the form of the abdomen and is very peculiar in that the scarcer and more aberrant form of female has characters approximating closely to those of the male. The remarkable point is that in this form the sides of

the abdomen are constricted as in the other sex. We have thus a female possessing a male character that can hardly be called secondary, for it can be demonstrated without difficulty that the purpose of the constriction in the male abdomen is that of permitting the copulatory appendages to remain exserted, while the abdomen is folded against the carapace.

This paper was almost completed before I became acquainted with Dr. Tesch's report on the Catometope crabs obtained by the 'Siboga' Expedition, published in 1918. In this report (pp. 40 *et seq.*) will be found a summary of the characters of the genera and species of the Scopimerinae and full descriptions of certain forms. My own work thus to a great extent covers the same ground as that traversed by Tesch, but there are considerable differences in our treatment, and, apart from the new species I have to introduce, an independent consideration of the subfamily will, I believe, have its uses.

Tesch gives to the subfamily the name Mictyrinae and includes in it Latreille's *Mictyris*, usually placed in a separate family. This view is not supported by any discussion and, having examined both the species belonging to Latreille's genus, I am unable to give my adherence to it.

Mictyris differs from the members of all other Catometope families in a number of very important features. Apart from the absence of defined orbits and the extraordinary disposition of the third maxillipeds, the mouth-parts differ widely from those of all genera of Ocypodidae with which I am acquainted, while in the possession of an unpaired accessory branchial orifice at the extreme posterior end of the carapace the genus is unique among Decapoda.[1]

[1] In nearly all Brachyrhynchous crabs water is normally drawn into the branchial chamber through an aperture at the base of the chelipeds and is expelled through the buccal cavern between the endostome and the distal ends of the outer maxillipeds. In *Mictyris* and in certain Ocypodid genera, all of which are amphibious in habit, accessory passages to the branchial cavity are to be found. The external orifices of these passages are rendered conspicuous by reason of a thick fringe of short hairs which doubtless serves to prevent the intrusion of particles of sand.

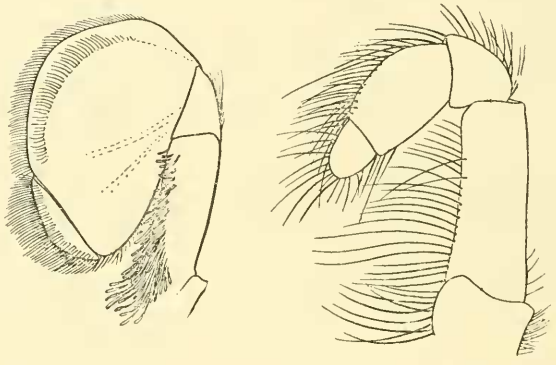
In *Ocypoda* and *Gelasimus* the orifice of the passage takes the form of a hairy-edged pouch situated between the bases of the 2nd and 3rd walking legs. From this pouch a channel passes upwards to the branchial cavity either through a gap between the upturned margins of the coxae (very conspicuous in *O. ceratophthalma*) or through an aperture behind their fused edges. In *Heloecius* similar pouches exist between both the 1st and 2nd and between the 2nd and 3rd walking legs. Of Scopimerine genera *Scopimera* possesses an accessory branchial passage with the orifice placed between the bases of the 1st and 2nd legs, and similar passages also exist in certain species of *Tympanomerus*, the orifices being found between the bases of the 1st and 2nd, 2nd and 3rd and (sometimes) the 3rd and 4th walking legs.

The unusual structure of the branchial opening at the base of the chelipeds in *Mictyris* has been described by Alcock, who does not, however, refer to the accessory passage also found in this genus. The orifice of this passage differs from that of all the Ocypodid genera referred to above in being unpaired. It is situated at the extreme hinder end of the animal and is bounded dorsally by the short posterior margin of the carapace and ventrally by a strong transverse ridge on the first abdominal segment, both upper and lower borders being heavily

I am of the opinion that the resemblances between *Mictyris* and the Scopimerinae are convergent rather than genetic and I cannot believe that the two have had a common origin distinct from that of the Ocypodinae and Macrophthalminae.

Apart from the position of *Mictyris* I differ from Dr. Tesch on a number of points of lesser importance.[1] With more material before me than was at his disposal I believe that I have been able to discover generic characters of more constant value than those utilised by him on p. 41 of his report.

In the possession of tympana, curious membranous areas found on the meral segments of the legs and sometimes on the thoracic sterna, the Scopimerinae differ from all other Decapoda; in some of the genera, however, they are ill-defined and in certain species of *Tympanomerus* they are altogether absent. The subfamily may be distinguished from the Ocypodinae by the presence



Text-fig. 1.

Endopod of second maxilliped.

a. Scopimera globosa, de Haan.

b. Tympanomerus gangeticus, sp. nov.

of a fully formed pleurobranch above the base of the second walking legs and from the Macrophthalminae by the more oblique position and rudimentary character of the antennules and by the greater breadth of the interantennular septum.

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fringed with short hairs. From the slit-like opening thus formed a narrow channel passes forwards on either side to the branchial cavity,

On placing a living specimen of *Gelasimus acutus* in a bowl of water and introducing a little coloured fluid at the base of the chelipeds I found that the fluid was immediately drawn in and expelled in the ordinary way through the upper part of the buccal cavern. I failed, however, to demonstrate that the accessory openings were similarly used in submerged individuals, even though an attempt was made to inject the fluid into the pouch, and think it probable that they are employed only for taking in air. The presence of the fringe of hairs suggests that they are inhalent rather than exhalent.

[1] For instance I regard *Dotilla sigillorum* as a species of *Scopimera*, *D. clepsydrodactylus* as a synonym of *D. intermedia* and *Cleistostoma lingulatum* as a species of *Tympanomerus*.

In recent years a large number of specimens of Scopimerinae have been added to the collection of the Zoological Survey of India. We are indebted to Lt.-Col. C. R. Stevens, I.M.S., for a most valuable series from Karachi, comprising examples of several new and scarce forms. Lt.-Col. H. J. Walton, I.M.S., has contributed further specimens of *Dotilla blanfordi*, hitherto known only from the types, and Mr. J. Hornell, a small but interesting collection from Tuticorin. I have to thank Dr. F. H. Gravely for a very long series of *Dotilla intermedia* from the Orissa coast, material which has enabled me to demonstrate the existence of dimorphism among the males. Dr. J. G. de Man has kindly sent me examples of *Tympanomerus pusillus*, Dr. Nakazawa and Dr. Bruno Parisi specimens of *Scopimera globosa*.

Excluding *Ilyoplax*, which cannot be recognised with certainty until the type species has been rediscovered, the genera of Scopimerinae may be distinguished by the following characters:—

I. Penultimate segment of 2nd maxilliped greatly expanded, with ultimate segment applied to it laterally as a narrow strip (text-fig. 1*a*).
  A. A conspicuous brush of hairs, indicating the position of the accessory branchial orifice, between bases of 1st and 2nd walking legs; 4th segment of abdomen not overlapping 5th, nor with a brush of hair at its distal end; abdomen of male with 4th or 5th segments constricted, the 5th occasionally linear. [Lateral walls of carapace usually without conspicuous sculpture.] ... *Scopimera*, p. 310.
  B. No brush of hairs between bases of walking legs; 4th segment of abdomen overlapping 5th and with a thick brush of hair at its distal end in both sexes; abdomen of male not constricted. [Lateral walls of carapace with deep convolute sculpture.] ... ... *Dotilla*, p. 324.

II. Penultimate segment of 2nd maxilliped not expanded, with ultimate segment attached terminally (text-fig. 1*b*). [4th segment of abdomen not overlapping 5th, nor with a brush of hair at its distal end.]
  A. Lateral walls of carapace with deep convolute sculpture: upper surface strongly sculptured; 4th segment of abdomen of male remarkably expanded, nearly 3 times as broad as fifth .. *Dotillopsis*, p. 334.
  B. Upper surface and lateral walls of carapace not conspicuously sculptured; 4th segment of abdomen of male not remarkably expanded though it may be broader than 5th ... ... *Tympanomerus*, p. 336.

The tympana are well-defined and usually conspicuous in *Scopimera* and *Dotilla*, ill-defined in *Dotillopsis* and ill-defined or absent in *Tympanomerus*. The merus of the third maxilliped is longer than the ischium in *Dotilla* and *Dotillopsis* and longer than or equal to the ischium in *Tympanomerus*; in some but not all the species of *Scopimera* the ischium is longer than the merus. A dense tomentum is found on the first three walking legs in *Dotillopsis* and similar but less extensive patches of hair are found in certain species of *Tympanomerus*.

The genera exhibit rather complex inter-relations. In the form of the abdomen and in the possession of hairy-edged pouches indicating openings into the branchial cavity *Scopimera* is related to *Tympanomerus*, while *Dotilla* and *Dotillopsis* agree in the deep sculpture of the upper surface and side-walls of the carapace. On the other hand *Scopimera* and *Dotilla* resemble each other and differ widely from *Dotillopsis* and *Tympanomerus* in the structure of the ultimate segments of the second maxilliped.

The genus *Ilyoplax*, which was described in 1858,[1] is based on a single species, *I. tenella*, "found at Whampoa, China, along the banks of the Canton River (brackish water), living in holes in the mud, exposed at low water." The fact that the meral segments of the legs possess tympana indicates that the genus must be referred to the Scopimerinae. Stimpson compares it with *Macrophthalmus* and remarks that it forms "a connecting link between the Macrophthalmidae and the Dotillidae." To my mind it is unquestionably a very close ally of *Tympanomerus* and I strongly suspect that it will prove to be synonymous with that genus. This, however, cannot be accurately determined until *I. tenella* has been rediscovered.

Genus **Scopimera**, de Haan.

1833. *Ocypode*, subgen. *Scopimera*, de Haan, in Siebold's *Faun. Japon., Crust.*, pp. 5, 24.
1852. *Scopimera*, Milne-Edwards, *Ann. Sci. nat., Zool.*, (3) XVIII, p. 153.
1900. *Scopimera*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 369.
1918. *Scopimera*, Tesch, *Decap. Brachyur.* 'Siboga' *Exped.* I, pp 41, 45.

The species may be distinguished by the following characters:—

1. Ischium of third maxillipeds longer than merus.
   - *A.* Mid-dorsal surface of carapace with large symmetrical puckers or vesicles; chela with strong carina near inferior border; last three segments of abdomen of male racket-shaped, the 5th linear, very much narrower than 6th or 7th ... ... *S. crabricauda.*
   - *B.* Mid-dorsal surface of carapace not conspicuously puckered; chela with inferior border rounded; 5th segment of abdomen of male not linear, little if at all narrower than 6th and 7th.
     1. Tympana on meral segments of walking legs not divided by a ridge.
        - *a.* Lateral border of carapace defined by a crest throughout its length; upper surface strongly granular; chelipeds of adult male little more than twice length of carapace ... ... *S. globosa.*
        - *b.* Lateral border of carapace defined by a crest only in its anterior half; upper surface feebly granular; chelipeds of adult male usually quite three times length of carapace. ... ... *S. pilula.*
     2. Tympana on meral segments of walking legs (except for that on upper surface of last leg) divided longitudinally by a narrow ridge.

[1] Stimpson, *Proc. Acad. Nat. Sci. Philadelphia* X, p. 98 (1858) and *Smithson. Misc. Coll.* XLIX, p. 100 (1907).

a. Antero-lateral portions of carapace much inflated and separated by an abrupt declivity from outer orbital angles; 4th segment of male abdomen anteriorly emarginate, not constricted, 5th longitudinally channelled; abdomen of female with convex lateral margins .. *S. investigatoris.*

b. Antero-lateral portions of carapace not greatly inflated, sloping gently to outer orbital angles; 4th segment of male abdomen much constricted anteriorly, 5th not channelled; abdomen of female with concave lateral margins . *S. proxima.*

II. Ischium of third maxillipeds shorter than merus. Chela with strong carina or row of granules near inferior border.]

A. Ischium and merus of outer maxilliped studded with coarse tubercles. [Merus about twice as long as ischium; carpus of male cheliped without tooth at inner angle.] ... ... *S. kochi.*

B. Ischium and merus of outer maxilliped smooth, or nearly so.

1. Upper surface of carapace sculptured; merus of third maxilliped three times as long as ischium; carpus of male cheliped?... ... ... *S. sigillorum.*

2. Upper surface of carapace without evident sculpture; merus of third maxilliped only a little longer than ischium; carpus of male cheliped with a tooth at inner angle .. .. *S. inflata.*

The species fall into four groups. Firstly the very highly specialized *S. crabricauda* which differs widely in the form of the male abdomen from any other species of the genus. Secondly *S. globosa* and *S. pilula* which are normal forms. Thirdly *S. investigatoris* and *S. proxima*, allied to the foregoing but distinguished by the presence of a ridge which bisects the tympana on the walking legs, and fourthly *S. kochi*, *S. sigillorum* and *S. inflata* which, though true Scopimeras, show affinity with *Dotilla* in the proportions of the merus and ischium of the third maxillipeds and in the presence of a certain amount of sculpture on the lateral walls of the carapace.

The brush of hairs between the bases of the first and second walking legs is very conspicuous in all the species of the genus that I have seen. A similar character is sometimes found in *Tympanomerus*, but occurs between the bases of other legs as well and is always much less easily detected.

S. crabricauda, *S. pilula*, *S. investigatoris* and *S. proxima* are Indian species.

Scopimera crabricauda, Alcock.

1900. *Scopimera crabricauda*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 370, and *Illustr. Zool. R.I.M.S. 'Investigator,' Crust.*, pl. lxiii, figs. 5, 5*a*, 5*b*.

In addition to the particulars given by Alcock it may be noted that in both sexes on the inner face of the chela there is a large blunt ridge, dorsally convex, extending from the base of the fixed finger to the carpal articulation. There are three finely serrate carinae on the fixed finger; the outer and inner reach only a short

distance on to the palm, but the median traverses its whole length, running externally a little above the lower border.

Two additional males of this scarce species, recently obtained by Lieut.-Col C. R. Stevens, I.M.S., are considerably smaller than the large male examined by Alcock; the carapace of the larger is only 5 mm. in length and 8·3 mm. in greatest breadth.

$\frac{1133}{4}$	Karachi.	A. O. Hume and F. Day.	Two. Types.
$\frac{9849}{10}$	Karachi.	C. R. Stevens.	Two.

Only these four specimens are known.

Scopimera globosa, de Haan.

Plate XII, fig. 2.

1835. *Ocypode (Scopimera) globosa*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 53, pl. xi, figs. 3, 3 *a*, *b*.
1852. *Scopimera globosa*, Milne-Edwards, *Ann. Sci. nat., Zool.* (3) XVIII, p. 153.
1858. *Scopimera tuberculata*, Stimpson, *Proc. Acad. Sci. Philadelphia* X, p. 98.
1894. *Scopimera globosa*, Ortmann, *Zool. Jahrb., Syst.*, VII, p. 747.
1898. *Scopimera globosa*, Koelbel, in *Wiss. Ergebn. Reise Grafen Béla, Széchenyi in Ostasien*, p. 572.
1902. *Scopimera globosa*, Doflein, *Abh. K. Bayer. Akad. Wiss.* XXI, p. 668.
1907. *Scopimera tuberculata*, Stimpson, *Smiths. Misc. Coll.* XLIX, p. 102.
1918. *Scopimera globosa*. Tesch, *Decap. Brachyur. 'Siboga' Exped.* I, p. 46, pl. iii, fig. 3.
1918. *Scopimera globosa*, Parisi, *Atti Soc. Ital. Sci. Nat.* LVII, p. 97, text-fig. 2.

The carapace is more than one and a half times as broad as long and its depth is slightly greater than its length. The upper surface is widest posteriorly, but the lateral walls slope outwards as well as downwards, the widest point being between the bases of the second pair of walking legs. The distance between the outer orbital angles is a little greater than the length.

The upper surface is covered with a very regular microscopic pitting, which gives it a dull appearance, and bears numerous smooth and shiny tubercles. The tubercles are most distinct on the lateral parts of the upper surface and on the branchial regions they tend to form transverse and oblique rugae; above the base of the last leg there is a clearly marked curved and serrulate ridge. On either side of the gastric region there is a conspicuous indentation from which shallow puckers or grooves radiate forwards, outwards and backwards. The gastric and cardiac regions are partially separated from one another by a very inconspicuous transverse furrow; their lateral boundaries are sharply defined.

The front is bluntly pointed and narrow, its breadth between the bases of the eyestalks being little more than a fifth the extra-orbital width. The edges of the front are raised and on each side there is a low granular ridge which curves inwards proximally, the

two almost meeting between the bases of the eyestalks. The central portion is depressed and smooth with a low longitudinal ridge or elevation.

The orbits have a strong dorsal inclination, the greater part of the cavity being visible in dorsal view. The upper border is sinuous and slopes obliquely backwards; it has a smooth raised rim and terminates in a blunt extra-orbital tooth. The lower border is sharply denticulate and strongly curved. On the floor of the orbit there is a fine beaded ridge which runs outwards from the base of the eyestalks and meets the lower border in the outer third of its length.

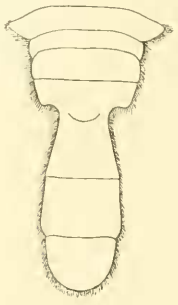
The lateral margin of the carapace is defined as a sharp crest extending from the orbital tooth to the base of the last legs; it is finely crenulate throughout and fringed with short setae. Both above and below the crest there is a smooth longitudinal groove. The side-walls of the carapace are finely granular and setose.

The endostomial margin almost touches the basal segments of the antennules and antennae, the epistome consisting merely of a median triangular plate bearing a sharp transverse carina. The expanded penultimate segment of the second maxilliped (text--fig. 1*a*, p. 308) is not covered with long hairs as in *S. pilula.*

The third maxillipeds bulge strongly. The ischium is longer than the merus and its breadth is a little greater than its length. The merus is nearly twice as broad as long and the suture between it and the ischium is decidedly oblique. The ischium is smooth except for some obscure granules postero-externally and for a raised line fringed with setae near the antero-lateral angle. There is a deep groove on the merus near its lateral border and on the inner side of the groove some low granules. A short blunt ridge runs to the articulation of the carpus. Antero-internally the surface of the merus is smooth and concave, with the margin reflected upwards.

The chelipeds of the male, if straightened, would be rather more than twice the length of the carapace. The merus has a tympanum on its outer side, in breadth about half that of the segment, and another, larger and less well defined on its inner surface; except for the tympana the segment is closely granular. The carpus is also granular and its upper surface is less than twice as long as broad in males. The three edges of the merus and the inner and outer edges of the carpus are rounded, not crested as in *S. pilula.* The chela is a little longer than the carapace and is nearly three times as long as high; its height near the carpal articulation is fully three quarters its greatest height. Both upper and lower borders of the palm are rounded and the entire surface, both within and without, is closely covered with squamiform granulation. The fingers are longer than the upper border of the palm, but shorter than its total length; each is glabrous with four longitudinal, finely serrate carinae. Except near the tip the prehensile edges of the fingers bear small teeth, a group on the dactylus a little behind its middle point being rather larger than the others.

The first and second walking legs are nearly three times the length of the carapace; the fourth pair is little more than two-thirds their length. The meri are expanded and bear very large tympana on both upper and lower surfaces. The dactyli in all four pairs are dorsally flattened; in the first three pairs they are a little longer than, in the last pair nearly one and a half times as long as the propodus. Except for the dactyli all the segments of the walking legs are finely granular and bear long scattered black bristles.



Text-fig. 2.—*Scopimera globosa*, de Haan. Abdomen of male.

In the abdomen of the male (text-fig. 2) the first three segments are short and broad. The fourth and fifth segments, taken together, are about as long as broad at base; in their proximal half they are deeply constricted, the least breadth being about half the length of the two combined. The suture between the fourth and fifth segments is deficient, not meeting the lateral margin on either side; it may be seen as a fine, anteriorly concave. groove crossing the narrowest part of the constriction. The sixth and seventh segments are each broader than long.

The carapace of a large male is about 8·7 mm. in length and 14 mm. in greatest breadth. I have not examined any females.

I agree with Koelbel that Stimpson's *S. tuberculata* is synonymous with *S. globosa*. Müller's record from Trincomali[1] is almost certainly erroneous and probably refers to *S. pilula*.

$\frac{97.9.1}{10}$	Kisarazu, Tokyo Bay.	K. Nakazawa.	Four.
$\frac{98.1.9}{10}$	Yokohama.	Mus. Milano (B. Parisi).	Five.

De Haan gives no precise locality for the specimens he described. Other records are Sagami Bay (Ortmann, Doflein), Nagasaki (Ortmann), Simoda (Stimpson) and Hongkong (Koelbel).

Scopimera pilula, sp. nov.

Plate XII, fig. 1.

? 1887. *Scopimera globosa*, Müller (*nec* de Haan). *Verh. Ges. Basel* VIII, p. 475.

This species is very closely allied to *S. globosa*, differing only in the following particulars.

The carapace is similar in shape to that of *S. globosa* and exhibits a shallow depression on either side of the gastric region. The puckers radiating from this depression are, however, much less

[1] Müller, *Verh. Ges. Basel* VIII, p. 475 (1887).

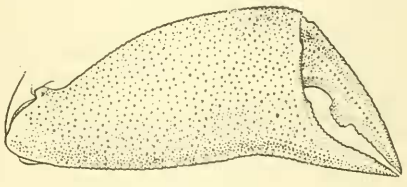
conspicuous and the entire upper surface more smooth. There are tubercles, most evident laterally, but all are smaller than in *S. globosa* and they do not tend to form transverse rugae. There is, however, a granular elevation near the extra-orbital angle and a protuberance near the base of the last pair of legs.

The lateral border, defined in *S. globosa* as a sharp crest running the whole length of the carapace, is deficient. It is visible for a short distance behind the orbital angle and the side-walls beneath it are longitudinally grooved, but further back it is altogether wanting, the side-walls in the posterior half of the carapace meeting the upper surface without interruption.

The front is slightly broader than in the allied species and is minutely nicked at the apex. The distal edge is thickened and behind it there is a large circular and completely circumscribed depression. There is a beaded ridge on the floor of the orbit as in *S. globosa*, but it is shorter and meets the lower orbital border at about its middle point.

The basal segments of the second maxillipeds bear very long woolly hairs which entirely conceal the distal segments when the appendage is normally flexed. The outer maxillipeds closely resemble those of *S. globosa*, but the merus is without granules and its sculpture is much less conspicuous.

The chelipeds of the adult male are very much longer than in *S. globosa*; in adults they are fully three times the length of the carapace. The edges both of the merus and carpus are crested. The carpus is proportionately much longer than in the allied species, the upper surface being more than two and a half times as long as broad. The segment is transversely rugulose above, not simply granular. The length of the chela (text-fig. 3) is distinctly greater than that of the carapace and differs in shape from that of *S. globosa*; the greatest height of the palm is about twice its height at the carpal articulation. The length of the dactylus is only about two-thirds that of the upper border of the palm. On both outer and inner surfaces the palm is covered with very fine granules which are arranged round small interspaces so as to give a reticulated appearance. The ridges on the fingers are similar to those of *S. globosa*, but the cluster of enlarged teeth near the middle of the inner margin of the dactylus is much more conspicuous.

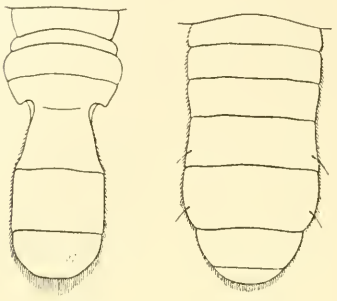


Text-fig. 3.—*Scopimera pilula*, sp. nov. Chela of male.

In the female the cheliped is only about twice the length of the carapace; the carpus is proportionately much shorter and the chela shorter, with fingers longer than the upper border of the palm The limb in consequence bears a close resemblance to that of male *S. globosa*, but the borders of the merus and carpus are crested.

The first and second walking legs are about two and a half times the length of the carapace and are thus a little shorter than in *S. globosa*. In other respects the legs show little difference: the merus is expanded, of similar proportions and bears large tympana.

The abdomen of the male (text-fig. 4*a*) is similar to that of the allied species but the fourth and fifth segments are a little longer than their basal breadth and are less deeply constricted; the breadth at the narrowest point is a little more than half the length. The sixth segment is about two-thirds as long as broad and the seventh nearly twice as broad as long. In the female (text-fig. 4*b*) the segments from the first to the fifth increase regularly in length; the fifth is about twice as broad as long and a shade wider than the fourth. The lateral margins of the abdomen are very slightly concave. In all the females the pleopods are covered with a thick felted growth which under low magnification resembles colonies of small Polyzoa and is usually extruded in bunches between the abdomen and the sternum. The growth in reality consists of stalks and broken shells of eggs from which the young crabs have escaped.



Text-fig. 4.—*Scopimera pilula*, sp. nov.
a. Abdomen of male.
b. Abdomen of female.

In large males the carapace is about 7·0 mm. in length and 10·6 mm. in greatest breadth. The females are a little smaller.

In a young male from the vicinity of Tuticorin with carapace 3·7 mm. in length the chelipeds do not show the characteristic sexual development, though they are normally developed in an individual from the Burma coast with carapace 4·0 mm. in length. The Tuticorin specimen appears to be abnormal and the collection of further specimens in the same locality might prove of interest.

There can be little doubt that Müller's record of *S. globosa* from Trincomali refers to this species.

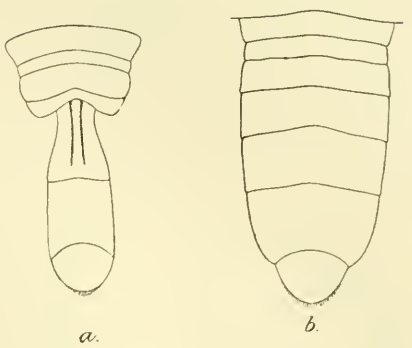
$\frac{9850-2}{10}$	Backwater at Pamban, Ramnad dist., S. India.	S. Kemp, Feb. 1913.	Many.
$\frac{9853}{10}$	Small lagoon near Tuticorin, S. India.	J. Hornell, Feb. 1918.	One.
$\frac{9851}{10}$	Paway (Pawe) I., Mergui Archipelago.	'Investigator,' Feb., 1914.	Two.

The types are from Pamban and bear the number 9850/10, *Zool. Surv. Ind.*

Scopimera investigatoris, Alcock.

1900. *Scopimera investigatoris*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 369, and *Illustr. Zool. 'Investigator,' Crust.*, pl. lxiii, figs. 4, 4*a*. *b*.

This species and *S. proxima* differ from all other members of the genus by the fact that the tympana on the meral segments of the walking legs, except for that on the upper surface of the last pair, are longitudinally divided by a narrow ridge; the tympana on the merus of the cheliped do not share this character. The two species may be contrasted with *S. inflata* and *S. kochi*, in which the tympana of the walking legs are normal, while that on the inner face of the merus of the cheliped is bisected.



TEXT-FIG. 5.—*Scopimera investigatoris*. Alcock.
a. Abdomen of male.
b. Abdomen of female.

I give a fresh figure of the abdomen in this species for comparison with that of the closely allied *S. proxima*.

The specimens of *S. investigatoris* described by Alcock are from Burma. Additional examples are from the western side of the Bay of Bengal:—

$\frac{2565-71}{7}$	Diamond I., off C. Negrais, Burma.	'Investigator.'	Eleven. TYPES.
$\frac{9510}{10}$	False Point, Orissa.	'Investigator.'	One (juv.)
$\frac{9511}{10}$	Chandipur, Balasore, Orissa.	F. H. Gravely, May, 1916.	Three.

At Chandipur the species was found in company with *Dotilla intermedia*, de Man.

Scopimera proxima, sp. nov.

Plate XII, fig. 3.

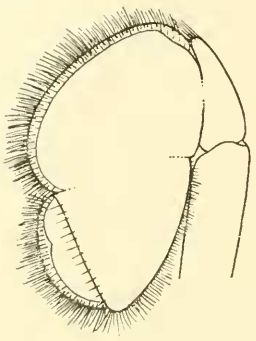
This species is an extremely close ally of *S. investigatoris*, but may be distinguished by its smoother carapace, less inflated antero-laterally and, in particular, by the different form of the abdomen.

The carapace is of similar proportions to that of the allied species and is about one and a half times as broad as long, with its depth about equal to its length.

In *S. investigatoris* a characteristic feature of the upper surface is the presence of an inflated and conspicuously granular area on each side near the antero-lateral angles. This area rises high above the orbital margin and is sharply defined anteriorly and externally by the steep and almost vertical declivity of its frontal and lateral borders, its separation from the outer orbital angle being conspicuous; posteriorly and internally it merges gradually into the general surface of the carapace. The granules of

this elevated area are continued backwards in irregular fashion, terminating in a cluster near the base of the last pair of legs. There are also scattered granules on other parts of the carapace, the gastric and cardiac regions excepted, and a few on either side of the basal part of the front near the insertion of the eye-stalks

In *S. proxima* the condition is different. The antero-lateral portions of the carapace are only a little swollen, the surface sloping gently upwards and backwards from the orbital border without any indication of the abrupt declivity seen in the allied species. The granules are fewer and much less conspicuous, though they may sometimes be traced backwards to the base of the last pair of legs. The other parts of the carapace are quite smooth and there are no tubercles at the base of the front.



Text-fig. 6. – *Scopimera proxima*, sp. nov. Endopod of second maxilliped.

When the carapace is viewed from in front the lower orbital border appears more strongly sinuous than in the allied species and the facet at its inner end more sharply defined.

The third maxillipeds closely resemble those of *S. investigatoris*; they do not, however, show any trace of the obscure granules often seen in large specimens of the latter species and there is merely a shallow furrow parallel with the outer border of the merus, in place of an incised groove.

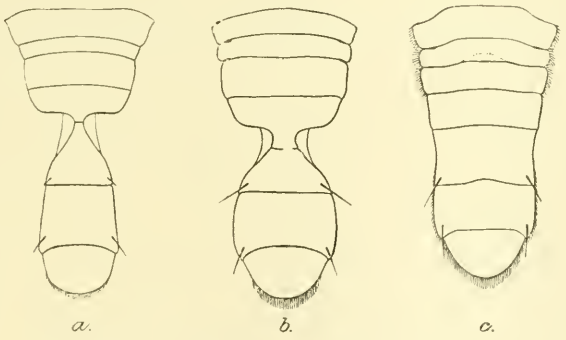
The chelipeds are short in both species and otherwise resemble each other very closely. In *S. proxima* all three edges of the merus are sharp and serrate, whereas in *S. investigatoris* the upper edge, though compressed, is distinctly rounded. In the latter species the inner limit of the upper surface of the carpus is defined proximally by a short crest which is wanting in *S. proxima*. The upper and lower borders of the palm are rounded in both species and there is little difference in the shape of the chela; the granulation is, however, a little coarser in *S. proxima* and the teeth on the prehensile edges of the fingers are larger and sharper. I have not found any distinctions in the walking legs.

The abdomen of the male of *S. investigatoris* has been figured by Alcock, but the form of the fourth segment is not quite correct, the distal angles being a little more produced than he has shown. I give a fresh figure of the male and female abdomen (text-fig. 5) for comparison with those of *S. proxima* (text-fig. 7). In *S. investigatoris* the fourth segment in the male is broad distally with produced outer angles, the fifth narrow, constricted at the base and deeply channelled, the sixth longer than broad with parallel sides. In *S. proxima* there is a very deep constriction at the junction of the fourth and fifth segments, the anterior end of the

former being exceedingly narrow[1]; the fifth segment is not channelled and the sixth is a little broader than long with straight, slightly divergent sides.

In the abdomen of the female the differences are less marked. In *S. investigatoris* (text-fig. 5*b*) it is rather broad, with slightly convex sides and with the seventh segment narrow; in *S. proxima* (text-fig. 7*c*) it is proportionately narrower, with the sides a trifle concave and the seventh segment broader.

Among a large number of specimens of *S. proxima* I have found ten in which the abdomen does not correspond with the normal type of either sex. In general outline (text-fig. 7*b*) the abdomen is similar to that of the normal male, but the constriction at the junction of the fourth and fifth segments is less deep, the fifth segment is proportionately broader and shorter and the sixth broader with convex lateral margins. On raising the abdomen four pairs of pleopods are found as in normal females.



TEXT-FIG. 7.—*Scopimera proxima*, sp. nov.
a. Abdomen of male.
b. Abdomen of abnormal female.
c. Abdomen of normal female.

At first it seemed probable that these specimens were males, infected by some parasite which had castrated them and rendered abortive the normal development of the secondary male characters. No parasite could, however, be discovered and on dissection ovarian eggs were found which differed in no respect from those obtained by the same method from normal females. There is, in consequence, very little doubt that the specimens are females and capable of breeding.

That very aged females occasionally assume some of the secondary sexual characters of the male is well known, but it does not seem probable that this will afford an explanation of the abnormal females in *S. proxima*. None of them is at all excep-

[1] The sides of the constricted portion are bevelled, so that the segments would appear broader if viewed from beneath.

tional in size and the presence of ovarian eggs indicates that they are capable of breeding and not, therefore, senile. The instance appears to be one of female sexual dimorphism, a phenomenon not, I believe, hitherto noticed among Decapod Crustacea.

It is very remarkable that the abdomen should be constricted in the abnormal females. In males the copulatory appendages can be exserted through the notches formed by the constriction and can remain in this position with the abdomen folded against the sternum: at the time of their capture many males of *S. proximа* were found with the appendages exposed. The modification of the abdomen seems thus to have a definite function in the male; in the female it is difficult to see how it can serve any useful purpose.

Of 87 specimens of *S. proxima* collected in Mormugao Bay in Portuguese India 50 are males, 31 normal females (2 ovigerous) and 6 abnormal females. Of 14 specimens from the neighbourhood of Tuticorin in S. India 9 are males, 4 normal females (1 ovigerous) and 1 an abnormal female. Of 16 specimens from Ennur backwater, near Madras, 6 are males, 7 normal females and 3 abnormal females.

In large males the carapace is about 4·4 mm. in length and 7 mm. in breadth.

$\frac{9812-4}{10}$	Vasco da Gama Bay, Mormugao Bay, Portuguese India.	S. Kemp; Aug., Sept., 1916.	Seventy-one.
$\frac{9815-6}{10}$	Donna Paula Bay, Mormugao Bay.	*do.*	Eleven.
$\frac{9817-8}{10}$	Bay N.W. of Nazareth Point, Mormugao Bay.	*do.*	Five.
$\frac{9855}{10}$	Silavathurai lagoon, nr. Tuticorin, S. India.	J. Hornell; Feb., May, 1918.	Fourteen.
$\frac{9867}{10}$	Ennur backwater, near Madras.	S. Kemp; May, 1918.	Sixteen.

Both in Mormugao Bay and near Tuticorin the species was found associated with *Dotilla myctiroides*, but the colonies of the latter were situated close to low-water mark, whereas those of *S. proxima* were higher up the beach, near high-water mark. In Mormugao Bay the species was found on ground that was sandy with a small admixture of mud. The burrows were widely separated, with pellets of sand neatly arranged in the customary manner. In many cases two, three or four 'runs' led to the mouth of the burrow, in place of the single one usually found in *Dotilla*. The 'runs' are long, sometimes as much as 1 ft.

The salinity of the water in Mormugao Bay varies with the state of the tide and doubtless also according to the season of the year; at the time of my visit, towards the end of the monsoon, it was everywhere brackish. The specific gravity in Vasco da Gama Bay was on one occasion 1·0165 (corrected).

The types are from Vasco da Gama Bay and bear the number 9812/10, *Zool. Surv. Ind.*

Scopimera inflata, A. Milne-Edwards.

1873. *Scopimera inflata*, A. Milne-Edwards, *Journ. Mus. Godeffroy*, Heft IV, p. 83.

In the collection of the Zoological Survey is preserved a single individual bearing the label "1423. *Scopimera inflata*, A. M.-Edw. Indian Ocean. Purchased." This specimen is one of very considerable interest and, though its history is not altogether free from doubt, there is every reason to believe that it is one of the original examples determined by A. Milne-Edwards.

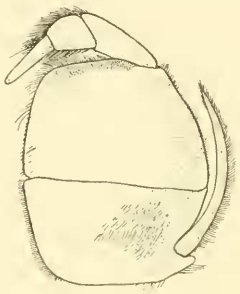
The register of the Crustacean collections contains under No. 1423 no information additional to that on the label, except that it is noted that only one specimen of the species was obtained. On the same page, however, are entries of a number of other Crustacea, also acquired by purchase and all apparently forming a single consignment, from Upolu, Samoa and the Viti Is. The entries were evidently made in 1875 or 1876. In the Annual Report of the Trustees of the Indian Museum for 1874-75 there is a statement that a collection of Crustacea "mostly from Southern Seas" was purchased from the Godeffroy Museum, while in the issue for 1875-76 it is noted that over 100 species of Crustacea (evidently a second consignment) were obtained from the same source. Mr. J. Wood-Mason, who came to Calcutta in 1869 as assistant Curator of the Indian Museum, devoted a great deal of time to the acquisition of a representative collection of named Crustacea—of this the registers and annual reports from 1873 and onwards contain abundant proof. He evidently took steps to obtain a set of duplicates from the Godeffroy Museum as soon as Milne-Edwards' paper appeared, and there can hardly be a doubt that the example of *S. inflata* was one of the specimens then acquired. It will be observed that in the original description the only note regarding locality is "Habite la mer des Indes."

The specimen is an adult female and is unfortunately in poor condition; the carapace is partially detached and the only legs remaining are those of the first two pairs. It is not possible to measure the carapace satisfactorily, but there can be no doubt that it is proportionately much broader than in other species of the genus. The length appears to have been 6·5 mm. or a little more, and the breadth at the orbital angles nearly 10 mm., the greatest breadth apparently exceeding 12 mm. These figures do not agree with those given by Milne-Edwards, who gives the length as 10 mm. and the breadth as 13 mm.; the former measurement perhaps represents the total length and not, as stated, that of the carapace only.

The upper surface of the carapace is very strongly convex antero-posteriorly, but in transverse direction is almost flat over the greater part of its breadth, sloping abruptly downwards on either side. Antero-laterally the surface is very greatly inflated, bulging upwards and forwards to such an extent that in a true dorsal view the upper orbital border is, in the middle of its length,

altogether concealed. The gastric and cardiac regions are smooth, but laterally the tubercles mentioned in the original description can be made out; apart from these the upper surface appears to be without evident sculpture. The side-walls are finely granular and seem to show traces of a rather deep sculpture, the grooves apparently forming a pattern somewhat similar to those found in *Dotilla myctiroides*; it is, however, difficult to be certain about this point owing to the poor condition of the specimen.

The epistome is very broad and exceptionally short. The penultimate segment of the second maxilliped is broader and the last segment more parallel-sided and proportionately longer and narrower than in other species of *Scopimera*. The third maxillipeds are also unusually broad and differ from normal species of the genus in having the ischium shorter than the merus (text-fig. 8). The ischium has a rather thick patch of hairs near its postero-lateral angle and the suture between it and the merus is nearly transverse. The merus is one third broader than long and decidedly longer than the ischium; it is very little narrowed distally and is angled antero-internally. The anterior margin is reflected upwards, a short ridge runs backwards from the carpal articulation and there is a deep groove parallel with the lateral margin.



Text-fig. 8.—*Scopimera inflata*, A. Milne-Edwards. Third maxilliped.

The chelipeds are about 15 mm. in length. There is a large tympanum on the inner face of the merus, subdivided longitudinally by a ridge as in Roux's *S. kochi*. The tympanum on the outer face is without this ridge and is a little smaller, though broad and in length about half that of the segment. Except for the tympana the entire segment is finely granular. A. Milne-Edwards in his description says "avant-bras allongé et armé d'une épine à son angle interne." This statement refers to the male. In the female there is no tooth, but the inner margin is concave and sharp-edged anteriorly and is obtusely angled in front of its middle point: in this respect there is a great difference between *S. inflata* and *S. globosa*. The carpus of the female is not elongate; its upper surface is about one and a half times as long as broad and is closely covered with granules. The chela is about 8 mm. in length and its greatest height, which is about twice that at the articulation of the carpus, is 3·7 mm. The whole palm is strongly compressed and the entire outer surface is conspicuously granular. The upper border is not carinate. On the outer side near the lower border there is a sharply defined beaded carina which extends from the proximal end to the distal third of the fixed finger; on the inner side a similar, but even more strongly marked, carina reaches from the carpal articulation to the middle of the inner side of the fixed finger.

The lower surface of the palm, bounded by these two crests, is only slightly convex; it bears rather large scattered granules, some of which towards the distal end are arranged in a single row and thus form a low ridge which extends to the middle of the finger. The fingers themselves are nearly twice the length of the upper border of the palm. On the prehensile edge of the fixed finger there is, in the basal two thirds, a series of small inconspicuous teeth; the same margin of the dactylus is similarly armed, but some of the teeth at the proximal end are situated on a low convex crest, the counterpart it would seem of the large triangular tooth found in this position in the male. On the upper and outer borders of the dactylus are longitudinal rows of granules.

In the first pair of walking legs, which alone remains in the specimen examined, the merus is a little more than twice as long as broad; it bears large tympana on both sides, not divided by a longitudinal ridge. The propodus is stout, a trifle more than twice as long as broad, and bears on its anterior face a strong longitudinal ridge The dactylus is one and a half times as long as the propodus. The abdomen is very broad covering practically the whole of the sternum.

Scopimera inflata is allied to *S. kochi*, Roux, and *S. sigillorum* (Rathbun). The three species resemble *Dotilla* and differ from normal members of the genus in two points,—(i) the merus of the outer maxillipeds is longer than the ischium and (ii) the side-walls of the carapace are to some extent sculptured. In *S. inflata* and *S. kochi* the tympanum on the inner face of the merus of the cheliped is divided longitudinally by a narrow ridge and the same character, though not mentioned in the description, is perhaps also to be found in *S. sigillorum*. In other species of *Scopimera* the tympana on the chelipeds are not bisected; but those on the walking legs are divided in an exactly similar manner in *S. investigatoris* and *S. proxima*.

There can be little doubt that *S. inflata* is correctly referred to the genus *Scopimera*. In the female I have examined the accessory branchial orifice is situated between the bases of the first and second walking legs and is thickly fringed with hair, while the abdomen does not possess the peculiar form invariably met with in *Dotilla*. The abdomen of the male, as described by Milne-Edwards, is similar to that of *S. globosa*.

Scopimera kochi, judging from Roux's excellent description, is a closely related form, differring in the sculpture of the upper surface of the carapace, in the form and coarse tuberculation of the outer maxillipeds and in the absence of a tooth at the inner angle of the carpus of the cheliped in the male.

S. sigillorum, described by Miss Rathbun as a species of *Dotilla*, is unfortunately known only from a single female specimen. The statement that the abdomen is subcircular indicates that it cannot be included in the genus *Dotilla* as here defined. In most respects the species appears to be very closely related to *S. inflata*, but the carapace is more distinctly areolated and

the merus of the outer maxilliped is proportionately much longer, being three times the length of the ischium. The brush of hair between the bases of the first two walking legs is not mentioned either by Roux or by Miss Rathbun.

Scopimera kochi, Roux.

1917. *Scopimera kochi*, Roux, in *Nova Guinea: Résultats Expéd. Sci. Néerl. Nouvelle-Guinea* V, Zool., p. 610, pl. xxvii, figs. 21-24.

Merauke, New Guinea.

Scopimera sigillorum (Rathbun).

1914. *Dotilla sigillorum*, Rathbun, *Proc. U.S. Nat. Mus.* XLVII, p. 83.

Sandakan Bay, Borneo.

I have not seen examples of either of these species. As noted above they appear to be related to *S. inflata*.

Genus **Dotilla**, Stimpson.

1835. *Doto*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 24.
1852. *Doto*, Milne-Edwards, *Ann. Sci. nat., Zool.*, (3) XVIII, p. 152 (*nom. praeocc.*).
1858. *Dotilla*, Stimpson, *Proc. Acad. Sci. Philadelphia*, p. 98.
1900. *Dotilla*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 363 (*in part*).
1918. *Dotilla*, Tesch, *Decap. Brachyur. 'Siboga' Exped.* I, pp. 41, 43 (*in part*).

From this genus I have separated two species, *D. brevitarsis*, de Man and *D. profuga*, Nobili, and have placed them in a new genus to which I have given the name *Dotillopsis*. The remaining species—in my opinion only eight in number—form a very homogeneous group, distinguishable at a glance from any other genus of crabs by the curious formation of the abdomen. The fourth segment overlaps the fifth and is furnished at its distal end with a conspicuous brush of hair.

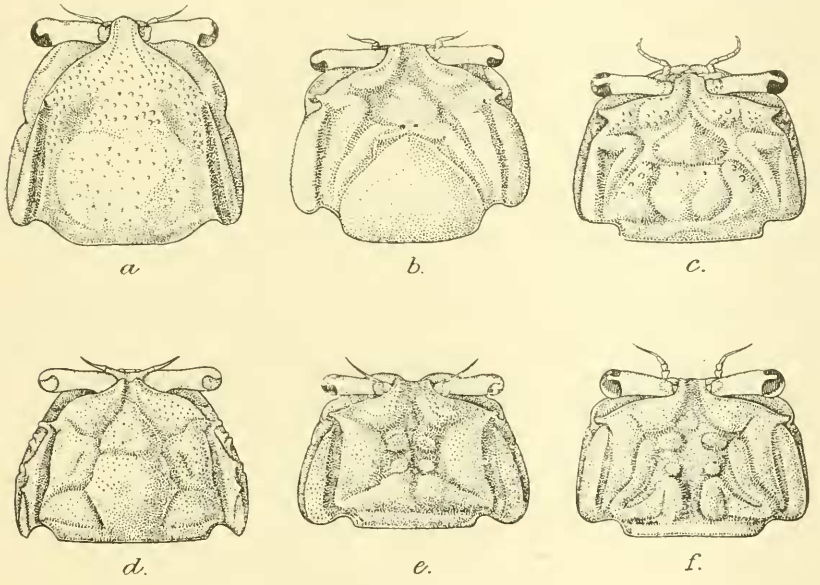
Many authors have remarked that they have seen no female *Dotilla*, but it does not appear that females are really scarce. The sexes, however, resemble each other so closely in the form of the abdomen that it is next to impossible to distinguish them without examination of the pleopods.

The genus shows affinity with *Scopimera* in the form of the distal segments of the second maxilliped, but lacks the accessory branchial passage found in that genus. In the deep convolute sculpture of the side-walls of the carapace it resembles *Dotillopsis* and, less markedly perhaps, the species of the *inflata*-group of *Scopimera*.

As regards the species, I have already referred Miss Rathbun's *D. sigillorum* to the genus *Scopimera* and, as noted above, two other species are placed in *Dotillopsis*. I agree with Nobili and Laurie that Alcock's *D. affinis* is synonymous with *D. sulcata*,

Forskål. *D. clepsydrodactylus*, Alcock, appears to me to be nothing more than a fully developed form of *D. intermedia*, de Man, while Stebbing's *D. clepsydra* does not seem to be distinguishable from Hilgendorf's *D. fenestrata*.

The mutual affinities of the species are best understood by a study of the grooves of the carapace. In text-fig. 9 will be found illustrations of the carapace of six species, the figures representing all the known types of sculpture. Two species I have not seen,—*D. fenestrata*, in which the sculpture is almost identical with that of *D. sulcata*, and *D. malabarica*, which in this respect bears a close resemblance to *D. pertinax*.



Text-fig. 9.—Carapace sculpture in *Dotilla*.

a. *D. myctiroides* (Milne-Edwards).
b. *D. sulcata* (Forskål).
c. *D. pertinax*, Kemp.
d. *D. wichmanni*, de Man.
e. *D. blanfordi*, Alcock.
f. *D. intermedia*, de Man.

The species are often difficult to determine, partly owing to the fact that the grooves of the carapace are not easy to observe and partly because samples from a particular locality frequently consist only of comparatively small individuals, to the exclusion of large males with well developed secondary sexual characters. I have already remarked (p. 306) that the absence of full grown males is, in certain cases at any rate, to be attributed to an unfavourable environment. Males of *D. intermedia* are subject to a well-marked dimorphism.

With the exception of *D. fenestrata* all the known species of *Dotilla* have been found on the Indian coast. They may be distinguished thus :—

I. Carapace as long as broad, except for the lateral grooves practically devoid of sculpture; chelipeds at least three times length of carapace. [Tympana on all segments of sternum][1] ... ... *D. myctiroides.*

II. Carapace broader than long its surface strongly sculptured; chelipedes at most little more than twice length of carapace.

A. Groove parallel to lateral margin of carapace anteriorly bifurcated or Y-shaped.

1. Two long parallel ∧-shaped grooves on dorsum of carapace, the lower enclosing a large triangular plane area with base occupying the whole of the posterior margin.

a. Tympana present on 2nd and 3rd segments of sternum; fingers of chela longer than palm, each in the adult male with a large tooth on its inner edge ... ... *D. fenestrata.*

b. No tympana on sternum; fingers of chela not longer than palm and without large teeth ... *D. sulcata.*

2. No parallel ∧-shaped grooves on dorsum of carapace; a cardio-intestinal area (much narrower than posterior margin) defined by lateral grooves.

a. Gastric area triangular; a faint transverse groove near posterior margin; dactylus of last leg not $1\frac{1}{2}$ times as long as propodus ... *D. pertinax.*

b. Gastric area pentagonal; no posterior transverse groove; dactylus of last leg 2ee as long as propodus ... ... *D. malabarica.*

B. Groove parallel to lateral margin of carapace simple, not bifurcated anteriorly.

1. Gastric and cardiac areas entire, not divided by a median longitudinal groove; transverse groove near posterior margin incomplete in the middle; no lobules isolated by grooves on gastric region; adult male with a tooth below orbital angle and a strong compressed tubercle on inner and proximal aspect of carpus of cheliped; tympana on all segments of sternum ... ... *D. wichmanni.*

2. A deep mid-dorsal groove extending from front to posterior margin; transverse posterior groove complete; 4 (or 5) small lobules on gastric region isolated by grooves; no tooth below orbital angle and no tubercle on carpus of cheliped; no tympana on sternum.

a. Only a single oblique groove running from side of cardiac region towards postero-lateral angle; lower surface of palm not carinate ... *D. blanfordi.*

b. Two oblique grooves running from side of cardiac region towards postero-lateral angle; lower surface of palm strongly carinate ... *D. intermedia.*

Dotilla myctiroides (Milne-Edwards).

1900. *Dotilla myctiroides*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 368.
1900. *Scopimera myctiroides*, Lanchester, *Proc. Zool. Soc. London*, p. 760, pl. xlvii, fig. 14.
1907. *Dotilla myctiroides*, Stimpson, *Smithson. Misc. Coll.* XLIX, p. 101.
1907. *Dotilla myctiroides*, Willey, *Spolia Zeylanica* V, p. 38.
1915. *Dotilla myctiroides*, Kemp, *Mem. Ind. Mus.* V, p. 227, fig. 8.

[1] Sternal tympana otherwise occur only in *D. fenestrata* and *D. wichmanni*.

References prior to 1900 are given by Alcock, who records the species from the Andamans and the Coromandel coast. Additional specimens are from the following localities:—

$\frac{9801}{10}$	Vasco da Gama Bay, Mormugao Bay, Portuguese India.	S. Kemp; Aug., Sept., 1916.	Thirty.
$\frac{9805}{10}$	Bay N. W. of Nazareth Pt., Mormugao Bay, Portuguese India.	*do.*	Six.
$\frac{9806}{10}$	Tuticorin, S. India.	J. Hornell; Feb., 1918.	Twenty-four.
$\frac{8935}{10}$	Pamban backwater, Ramnad dist., S. India.	S. Kemp; Feb, 1913.	Seven.
$\frac{8934}{10}$	Ennur backwater, nr. Madras.	N. Annandale; Oct., 1913.	One (ovig,).
$\frac{8933}{10}$	Outer channel of Chilka Lake, Orissa.	Chilka Survey, March, 1914.	One.
$\frac{9856}{10}$	Maungma-gan, Tavoy, Burma.	J. Coggin Brown.	Five.
$\frac{8936}{10}$	Paway (Pawe) I., Mergui Archipelago.	'Investigator,' Feb., 1914.	Four.
$\frac{9857}{10}$	Port Blair, Andamans.	R. P. Mullins; June, 1918.	Seven.

In the first of these localities the species was exceedingly abundant on sandy ground with a small admixture of mud. The colonies occupied extensive tracts near low-water mark; the burrows were very closely packed together and the whole surface of the sand was covered with pellets to a depth of nearly an inch. It is perhaps due to this overcrowding that the specimens are decidedly smaller than usual, none exceeding 6·5 mm. in length of carapace. With the species, but in isolated burrows near high-water mark, was found *Scopimera proxima* and Mr. Hornell found the two forms associated in the same way at Tuticorin.

Dotilla myctiroides is frequently found in places where the water is brackish. Dr. Annandale found an ovigerous female in such a situation at Ennur and, at the time specimens were taken, the specific gravity of the water in Vasco da Gama Bay was 1·0165 (corrected).

The species has been recorded from Mahé (Milne-Edwards),[1] Rameswaram I., Tuticorin and Ennur (Henderson), Singapore (Walker, Lanchester), Java (Brit. Mus., *fide* Henderson), Gaspar Straits (Stimpson) and Billiton I. and Mindanao (Aurivillius). Henderson gives "Seychelles (Miers)," but I have not succeeded in tracing the record.

Dotilla fenestrata, Hilgendorf.

1843. *Doto sulcatus*, Krauss, *Sudafrik.-Crust.*, p. 39 (Stuttgart).
1869. *Dotilla fenestrata*, Hilgendorf, in von der Decken's *Reisen Ost.-Afrika* III, p. 85, pl. iii, figs. 5, 5*b*,*c*.
1879. *Dotilla fenestrata*, Hilgendorf, *Monatsb. K. Preuss. Akad. Wiss.*, 1878, p. 806.
1884. *Dotilla fenestrata*, Miers, *Zool. H.M.S.* '*Alert*,' p. 543.
1893. *Dotilla fenestrata*, Aurivillius, *Nov. Act. Reg. Soc. Sci. Upsala*, ser. III, p. 12, pl. i, figs. 14, 15.

[1] Presumably the Mahé on the Malabar coast.

1894. *Dotilla fenestrata*, Ortmann, *Zool. Jahrb., Cyst.*, VII, p. 748.
1905. *Dotilla fenestrata*, Lenz, *Abh. Senck. Naturf. Ges. Frankfurt* XXVII, p. 367.
1917. *Dotilla clepsydra*, Stebbing, *Ann. Durban Mus.* II, p. 18, pl. v.

Stebbing records *D. clepsydra* from Durban Bay and compares it with Alcock's *D. clepsydrodactylus* (=*D. intermedia*, de Man), which it resembles in the structure of the chela of the adult male. Apparently, however, he has failed to notice that *D. fenestrata*, which also inhabits the S. African coast, possesses a chela of precisely this type.

I have little doubt that the two are synonymous. Judging from the very rough figure the sculpture of the carapace is of the type found in *D. fenestrata* and in the figure of the under surface there appears to be an indication of a tympanum on the second segment of the abdominal sternum, the third segment not being represented.

The only discrepancy is that *D. clepsydra* possesses a tooth at the proximal end of the lower surface of the merus of the cheliped. In males of *D sulcata* this tooth may be present or absent, but its existence is not mentioned in any description of *D. fenestrata.*

Of this species, which is restricted to the southern and eastern coasts of Africa, I have seen no specimens. It has been recorded from Zanzibar (Aurivillius, Lenz), Ibo (Hilgendorf), Mozambique (Hilgendorf, Miers), Inhambane (Hilgendorf), Durban Bay (Stebbing) and the Cape of Good Hope (Ortmann).

Dotilla sulcata (Forskål).

1775. *Cancer sulcatus*, Forskål, *Descript Anim.*, p. 92 (Hauniae).
1800. *Myctiris sulcatus*, Audouin, *Descript. de l'Egypte, Hist. Nat.*, I, *Explic. sommaire des planches*, p. 81; Savigny, *ibid.*, *Planches, Crust.*, pl. 1, figs. 3, i-iv (1817).
1829-44. *Myctiris sulcatus*, Guérin, *Icon. Regne Anim., Crust.*, pl. iv, figs. 5, 5*a-b*.
? *Myctiris sulcatus*, Milne-Edwards, in Cuvier's *Regne Anim., Atlas*, pl. xviii, figs. 3, 3*a*, *b*.
1833. *Ocypode* (*Doto*) *sulcata*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 24.
1837. *Doto sulcatus*, Milne-Edwards, *Hist. nat. Crust.* II, p. 92.
1850. *Doto sulcatus*, Lucas, *Hist. Nat. Anim. Artic., Crust.*, p. 61, pl. ii, fig. 1.
1861. *Doto sulcatus*, Heller, *Fitz. Kais. Akad. Wiss. Wien* XLIII, p. 361.
1888. *Dotilla sulcata*, de Man, *Journ. Linn. Soc., Zool.* XXII, p. 130.
1889. *Doto sulcatus*, Cano, *Boll. Soc. Nat. Napoli* III, p. 249.
1892. *Dotilla sulcata*, de Man, in Weber's *Zool. Ergebn. Reise Ned. Ost-Ind.* II, pp. 309-13.
1900. *Dotilla affinis*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 365, and *Illustr. Zool. 'Investigator,' Crust.*, pl. lxiii, figs, 1, 1*a*, *b*.
1906. *Dotilla sulcata*, Nobili, *Ann. Sci. nat., Zool*, (9) IV, p. 315.
1915. *Dotilla sulcata*, Laurie, *Journ. Linn. Soc., Zool.* XXXI, p. 467.

I agree with Nobili and Laurie that *D. affinis* is synonymous with *D. sulcata*. The tooth at the proximal end of the lower surface of the male cheliped is well developed only in large individuals; the types of Alcock's species are all small, but the tooth

is present in a rudimentary condition in the two largest males. In a series of five specimens recently obtained by Capt. R. B. Seymour Sewell, I.M.S., in the Gulf of Suez, the tympanum on the upper surface of the last leg is present in two very small specimens and in a female of medium size; in a small male and large female it is altogether absent.

The specimens examined are:—

$\frac{1135}{1}$	Red Sea.	Berlin Mus.	Three.
$\frac{1173}{1}$	Aden and Mekran coast.	'Investigator.' TYPES of *D. affinis*, Alc.	Four.
$\frac{9807}{10}$	Ain Musa, Gulf of Suez.	R. B. Seymour Sewell.	Five.

Other precisely localized records of *D. sulcata* are,—Suez (Forskål, Laurie), Tor (Heller), Aden (Nobili) and Djibouti (Nobili)

Dotilla pertinax, Kemp.

1915. *Dotilla pertinax*, Kemp, *Mem. Ind. Mus.* V, p. 222, pl. xii, fig. 4.

Examination of further specimens shows that, as in *D. sulcata*, the tympanum on the upper surface of the last pair of legs may be present or absent. This character, therefore, will not serve to distinguish the species from Nobili's *D. malabarica*, to which in the pattern of the grooves on the carapace it is clearly related.

$\frac{8937-8}{10}$	Outer channel of Chilka Lake, Orissa.	Chilka Survey, March, Oct., 1914.	Many (including TYPES).
$\frac{9433}{10}$	Puri, Orissa.	S. Kemp; March, 1916.	Seventeen.

The specimens obtained at Puri were found at the edge of a small pool of brackish water separated by a sandbank from the open sea. At exceptional tides sea-water made its way into the pool.

Dotilla malabarica, Nobili.

1903. *Dotilla malabarica*, Nobili, *Boll. Mus. Torino* XVIII, No. 452, p. 20, fig. 6.

I have not seen this species, which is evidently closely related to *D. pertinax*. It differs in the sharply pentagonal form of the gastric area—clearly shown in Nobili's figures, in the generally deeper sculpture of the carapace and in the absence of a transverse groove near the posterior border. The fingers also appear to be much shorter in relation to the palm and the dactylus of the last leg longer, twice the length of the propodus. On actual comparison of specimens other distinctions will probably be discovered.

Dotilla malabarica is known only from the original examples obtained at Mahé on the Malabar Coast (E. Deschamps coll.). I have endeavoured without success to obtain further specimens.

Dotilla wichmanni, de Man.

1892. *Dotilla wichmanni*, de Man, in Weber's *Zool. Ergebn. Reise Nied. Ost.-Ind.* II, p. 308, pl. xviii, fig. 8.

1895. *Dotilla wichmanni*, de Man, *Zool. Jahrb., Syst.*, VIII, p. 577.

1910. *Dotilla wichmanni*, Rathbun, *Dansk. Vid. Selsk. Skrift.* (7), *naturvid. og math.*, V, p. 324.
1918. *Dotilla wichmanni*, Tesch, *Decap. Brachyur. 'Siboga' Exped.* I, p. 45.
1918. *Dotilla wichmanni*, Kemp, *Mem. Asiat. Soc. Bengal* VI, p. 227, text-fig. 1.

In the last-quoted paper I have given an account of a series of very large specimens obtained by Dr. Annandale in Lower Siam. Large males from this locality exhibit strong secondary sexual characters in the presence of certain angular projections on the sides of the carapace, the most conspicuous being spinose in character and situated beneath the outer orbital angle. There is also in the fully developed male a prominent compressed tubercle on the inner face of the carpus close to the meral articulation.

Tesch notes the presence of two tympana on the outer face of the merus of the chelipeds; both are distinct in the specimens I have seen and a similar character is frequently, but not always, met with in *D. intermedia*.

In the conformation of the grooves on the carapace *D. wichmanni* differs markedly from any other species of the genus. In the form of the lateral grooves it shows affinity with *D. blanfordi* and *D. intermedia* but otherwise there are few points of resemblance. Apart from *D. myctiroides* it is the only species which possesses tympana on all the segments of the abdominal sternum.[1]

$\frac{9130}{10}$	Kaw Deng, near Singgora, Gulf of Siam.	N. Annandale; Jan., 1916.	Thirty-one.
$\frac{9131}{10}$	Corbyn's Cove South, Port Blair, Andamans.	S. Kemp; March, 1915.	Sixty-five.

The specimens from Port Blair are all small and the secondary sexual characters of the males are not developed. One of Dr. Annandale's specimens is ovigerous.

The species has been recorded from Celebes, Makassar and Atjeh in Sumatra (de Man), the Talaut Is. (Tesch) and from Koh Kong in the Gulf of Siam (Rathbun).

Dotilla blanfordi, Alcock.

1900. *Dotilla blanfordi*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 366, and *Illustr. Zool. 'Investigator,' Crust.*, pl. lxiii, figs. 3, 3*a*.

We are indebted to Lieut.-Col. H. J. Walton, I.M.S., for further examples of this species, which like most other Scopimerinae appears to be local rather than rare. The additional specimens are considerably smaller than the types; the carapace of the largest male is only 4·2 mm. in length and that of the single ovigerous female only 3·0 mm.

In the sculpture of the carapace this species shows affinity with *D. intermedia*, a form which appears to be restricted to the Bay of Bengal.

[1] For my observations on this point see the paper cited above.

$\frac{41\,32}{-\,4}$ $\frac{37\,00}{10}$	Bombay and Karachi.	A. O. Hume, F. Day and W. T. Blanford.	Four. TYPES.
$\frac{98\,59}{10}$	Oran I., Bombay.	H. J. Walton; April, May, 1918.	Thirty-eight.

Not known from any other locality.

Dotilla intermedia, de Man.

1888. *Dotilla intermedia*, de Man, *Journ. Linn. Soc. Zool.*, XXII, p. 135, pl. ix, figs. 4-6.
1900. *Dotilla clepsydrodactylus*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 367, and *Illustr. Zool. Investigator, Crust.*, pl. lxiii, figs. 2, 2*a*.
1915. *Dotilla clepsydrodactylus*, Kemp, *Mem. Ind. Mus.* V, p. 226.

Examination of a very fine series of specimens, recently collected by Dr. F. H. Gravely at Chandipur in Orissa, has convinced me that *D. clepsydrodactylus* is synonymous with *D. intermedia*. I have seen the types of both forms and find that the configuration of the grooves of the carapace is identical. *D. intermedia* was described by de Man from a number of small specimens [1] in which the characters of the adult male chela were not developed.

Altogether I have examined 316 specimens of this species, of which 235 (148 males and 87 females) were obtained by Dr. Gravely at Chandipur on the Orissa coast. Among the males from this locality two very distinct dimorphic forms occur, which may be termed "high" and "low."

In the "high" male, which is the type described by Alcock, the first abdominal sternum bears a sharp transverse ridge on either side of the trough formed to receive the terminal segment of the abdomen and well behind its anterior limit. The fingers of the chela each bear a large lobe or tooth near the middle of their prehensile edge. The copulatory appendage is blunt at the tip and furnished with numerous setae.

In the "low" male the first abdominal sternum bears anteriorly a pair of large outstanding triangular teeth; these are in advance of the anterior limit of the abdominal trough and are thus placed considerably further forwards than the ridges in the "high" male. The dactylus of the chela bears a low rounded lobe near the base of its prehensile edge (further back than in the "high" male) and there is no lobe or large tooth on the fixed finger. The copulatory appendage is more slender, strongly sinuous, and terminates in a fine point which is turned inwards and does not bear conspicuous setae.

That these two types of male belong to the same species is, I believe, incontestable. In the form and areolation of the carapace they resemble each other exactly and they were, moreover, all found in the same locality.

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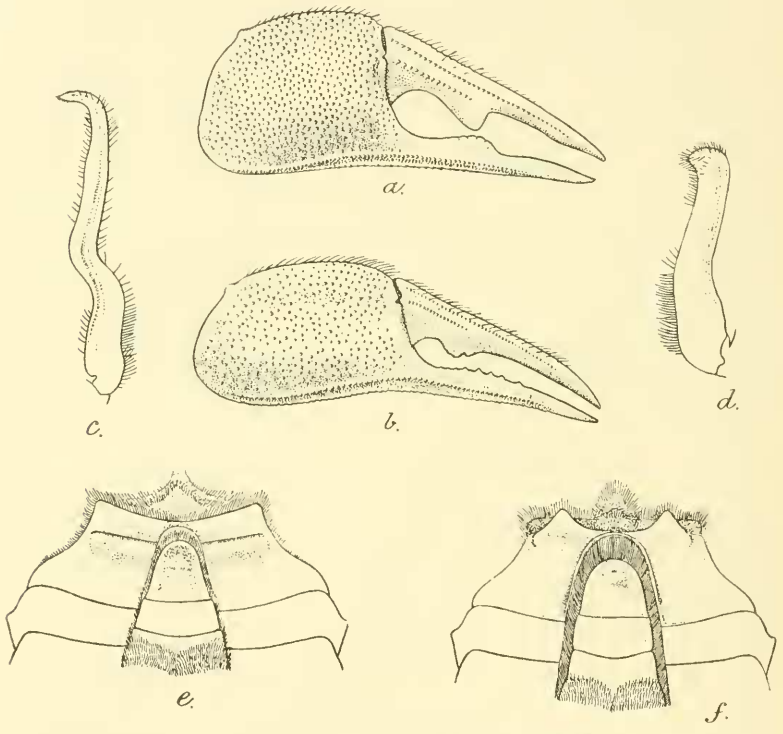
[1] De Man described the species from 32 specimens, "all males." Of these 14 are in the collection of the Zoological Survey of India, labelled "types" in de Man's handwriting. De Man was mistaken as to the sex of his specimens, for 7 of those examined are females.

All well-grown males can be referred without the least hesitation to one or other dimorphic form; the "high" males reach a larger size, the carapace being sometimes as much as 5·5 mm. in length, whereas the "low" males rarely exceed 4·5 mm. In specimens of medium size the characters of the sternum and chela are less well developed, though as a rule perceptible, but in very small individuals, from 2·0 to 3·0 mm. in length, it is usually not possible to detect them. The form of the copulatory appendage appears,



Text-fig. 10.—*Dotilla intermedia*, de Man.

a. Chela of "high" male.
b. Chela of "low" male.
c. Copulatory appendage of "low" male.
d. Copulatory appendage of "high" male.
e. Abdominal sternum of "high" male.
f. Abdominal sternum of "low" male.

however, to be quite constant; I have examined it in all the specimens and have never once been in doubt.

At Chandipur Dr. Gravely collected specimens on three occasions, the numbers being as follows:—

	"High" males.	"Low" males.	Females.
June, 1915.	17	6	15 (1 ovig.)
May, 1916.	46	18	39 (17 ovig.)
May, 1917.	41	20	33 (3 ovig.)
	104	44	87

It seems therefore that "high" males are very much commoner than "low" males, and that males (both forms included) are nearly twice as abundant as females.[1]

I am not at all certain as to the meaning of the dimorphism in this species. Of both types of male there is a series ranging from very small to full-grown specimens, a fact which perhaps discounts the possibility that they represent breeding and non-breeding phases. On the other hand it is very improbable that more than one type of copulatory appendage can be employed in the sexual process. In other species of *Dotilla* the appendage is generally blunt at the tip, resembling that of the "high" male, a circumstance which points to the conclusion that the "low" males do not breed.

The examples of *D. intermedia* that I have seen from other localities are mostly of small size and (determined mainly by the form of the copulatory appendage) consist entirely of "high" males and females.

Several observations indicate that environment has a great influence on species of *Dotilla*, its effects being shown both in the size of the specimens and in the degree of development of the secondary sexual characters of the male. Thus the individuals of *D. intermedia* that we obtained in the outer channel of the Chilka Lake in Orissa were all small and it was only with difficulty that a few specimens were obtained which showed in an imperfect degree the peculiar character of the "high" male chela. In this locality with its extreme seasonal changes in salinity, there can be little doubt that the environment is unfavourable. A somewhat similar instance has been noticed in *D. wichmanni* (see p. 330).

At Chandipur it is clear that the environment is peculiarly favourable for *D. intermedia* and that "low" males were found here and not in any other place in which the species has been collected, is perhaps in some way correlated with this fact.

The following specimens have been examined:—

$\frac{8236}{6}$	Sullivan I., Mergui Archipelago.	Mus. Collr.	Fourteen. Types.
$\frac{438-45}{7}$	False Point, Orissa.	'Investigator.' Types of *D. clepsydrodactylus*, Alc.	Seven.
$\frac{8939}{10}$	Outer Channel, Chilka Lake, Orissa.	Chilka Survey; March, 1914.	Thirty-five.
$\frac{9194}{10}$	Ennur backwater, nr. Madras.	N. Annandale.	Twenty (juv.).
$\frac{9192-3}{10}$	Chandipur, Balasore, Orissa.	F. H. Gravely; June 1915; May, 1916; May, 1917.	Two hundred and thirty-five.
$\frac{9860}{10}$	Maungma-gan, Tavoy, Burma.	J. Coggin Brown.	Five.

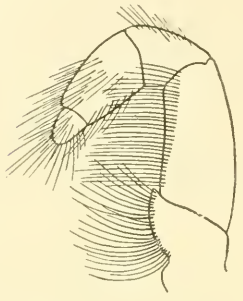
The species has not been recorded from any other locality.

[1] The abdomen in the genus *Dotilla* shows little difference in outline in males and females. In determining the sex it is therefore necessary to examine the pleopods, unless the specimens are ovigerous or with the male secondary characters strongly developed.

Genus **Dotillopsis**, nov.

This genus, which is established for *Dotilla brevitarsis*, de Man and *D. profuga*, Nobili, may be recognised by the following combination of characters :—

The carapace is cuboidal rather than globose and deeply grooved above. The side-walls possess the deep convolute sculpture seen in *Dotilla*. The penultimate segment of the second maxilliped is but little expanded and the ultimate segment is terminal in position. The merus of the outer maxilliped is longer than the ischium and is gyrous-sulcate. The meral segments of the legs bear ill-defined tympana. In the first three pairs of walking legs the merus, carpus and propodus are densely tomentose inferiorly. The abdomen consists of seven distinct segments; the fourth segment does not overlap the fifth and does not bear a brush of hairs at its distal end. In the male the fifth, sixth and seventh segments are narrow, the fifth not deeply constricted; the fourth segment is greatly expanded and produced on either side, its breadth being nearly three times that of the fifth. In the female the abdomen is broadly oval.



Text-fig. 11.—*Dotillopsis brevitarsis* (de Man).
Endopod of second maxilliped.

Type.—*Dotilla brevitarsis*, de Man.

The genus is in some respects intermediate between *Dotilla* and *Tympanomerus*; it agrees with the former in the deep sculpture of the upper surface and lateral walls of the carapace and with the latter in the structure of the ultimate segments of the second maxilliped. The abdomen differs altogether from the very characteristic type found in *Dotilla*; in the male it shows signs of considerable specialization and has little resemblance to that found in any other genus of the subfamily.

The presence of a dense tomentum on the first three walking legs, a character also found in a few species of *Tympanomerus*, is almost certainly an adaptation to environment; the species of *Dotilla* are in my experience always found burrowing in clean firm sand, whereas *Dotillopsis brevitarsis* lives in the softest mud. Nobili's *D. profuga*, which I have not seen, probably also lives in mud, being described from the Upper Sadong River in Borneo.

The two species of the genus may be distinguished thus :—

I. Sculpture of carapace sharp; frontal groove continued almost to posterior margin; palm with conspicuous longitudinal carinae on its lower and inner aspects ... *D. brevitarsis.*

II. Sculpture of carapace indistinct; frontal groove reaching only to gastric region; palm without longitudinal carinae. ... ... *D. profuga.*

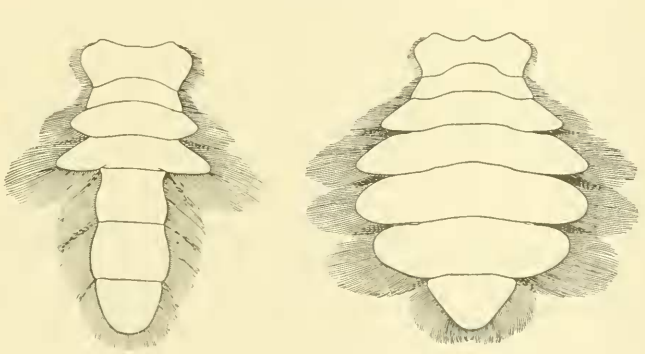
Dotillopsis brevitarsis (de Man).

1888. *Dotilla brevitarsis*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 130, pl. ix. figs. 1-3.
1900. *Dotilla brevitarsis*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 367.

Plate XIII, fig. 1.

A number of additional specimens of this species have recently been obtained in the Gangetic Delta. The species was found at Port Canning and near the junction of the Matlah and Biddah rivers, living between tide-marks on a bank of exceedingly soft mud. The crab appears to have habits similar to those of the species of *Dotilla*; but, owing to the semiliquid consistency of the mud, the burrows do not retain their form and the pellets brought to the surface rapidly disappear. On one of the occasions on which specimens were obtained, in December 1916, the water was brackish, its specific gravity (corrected) being about 1·0105.

I have nothing to add to de Man's excellent description, but



TEXT-FIG. 12.—*Dotillopsis brevitarsis* (de Man).
Abdomen of male (left), of female (right).

give a fresh figure of the animal (pl. xiii, fig. 1) and outline drawings of the second maxilliped (text-fig. 11) and of the abdomen in each sex (text-fig. 12).

In adult males the carapace is grey, white above the bases of the legs and on the outer maxillipeds. The chelipeds are entirely bright orange red except for the upper surface of the carpus, which is grey. The walking legs are grey at the base, with the two terminal segments pure white. In the first three pairs there is a large red or orange-red patch on the anterior surface of the merus and, in the first two pairs, a similar patch on the posterior surface of the same segment. Adult females are similarly coloured, but frequently with orange instead of red or orange-red pigment and with the colour less pronounced on the walking legs. The eggs are deep reddish-purple, turning yellow in spirit.

In the largest specimen obtained the carapace is about 8 mm. in length and 10·5 mm. in breadth.

$^{8}\frac{25.5}{6}$	Mergui Archipelago.	Mus. Collr.	Three (fragmentary).
$\frac{23.7.5}{7}$	Diamond I., off C. Negrais, Burma.	'Investigator.'	One.
$^{18}\frac{01.3}{10}$	Kaikal Maree, nr. junction of Matlah and Biddah Rs., Gangetic Delta.	S. Kemp; Dec., 1916.	Eighty.
$^{9}\frac{8.0.9}{10}$	Matlah R., opposite Port Canning, Gangetic Delta.	Bengal Fish. Dept. (B. Prashad); March, 1918.	Seven.

The species is not known from any other locality. The fragmentary specimens from the Mergui Archipelago appear to be paratypes.

Dotillopsis profuga (Nobili).

1903. *Dotilla profuga*, Nobili, *Boll. Mus. Torino* XVIII, No. 447, p. 22.

Upper Sadong R., Borneo.

Genus Tympanomerus, Rathbun.

1835. *Cleistostoma*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 26.
1888. *Dioxippe*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 137 (*nom. praeocc.*).
1897. *Tympanomerus*, Rathbun, *Proc. Biol. Soc. Washington* XI, p. 164.
1900. *Tympanomerus*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 371.
1918. *Tympanomerus*, Tesch, *Decap. Brachyur. 'Siboga' Exped.* I, p. 48

This genus shows signs of affinity with *Scopimera* in the form of the abdomen and in the presence of accessory branchial passages between the bases of the walking legs. It differs, however, from both *Scopimera* and *Dotilla* and resembles *Dotillopsis* in the form of the ultimate segments of the second maxilliped. From *Dotillopsis* it is readily distinguished by the absence of convolute grooves on the side-walls of the carapace, by the much less strongly sculptured dorsal surface and by the less broadly expanded fourth segment of the male abdomen.

Tympana, which are uniformly found in all other Scopimerinae, are sometimes absent in species of this genus; when present, they are usually ill-defined and difficult to observe.

Tesch has drawn attention to the presence of hairy-edged pouches or orifices of accessory branchial passages in species of this genus. In both *T. ceratophora* and *T. integer* he found two pairs, situated between the bases of the first and second and the second and third walking legs. I have found these pouches in *T. pusillus*, *T. lingulatus* and *T. stapletoni*,—in the last-named species they occur between the third and fourth legs also. In five other forms that I have examined the tufts of hair are absent or very poorly developed and I am not satisfied that accessory branchial passages exist.

Stimpson's genus *Ilyoplax*, which cannot be identified with certainty until the type species has been rediscovered (see p. 310), is evidently related to *Tympanomerus* and it seems very probable that the two will prove to be synonymous. Should this happen

the unfortunate term *Tympanomerus* will disappear from nomenclature, for *Ilyoplax* has long priority.

The species may be distinguished thus:—

1. Eyestalk without projecting terminal style.
   A. Carpus of cheliped without a tooth on its inner aspect. [Carpus short, its upper surface about $1\frac{1}{2}$ times as long as broad.]
      1. Carapace pentagonal, the orbits being decidedly oblique; outer surface of palm granular or with squamiform rugosities.
         a. Lateral border of carapace notched behind outer orbital angle; male abdomen with all segments distinct, distal angles of 4th segment not produced.
            i. Granules on outer surface of palm arranged in a reticulate manner; a strong crenulate carina on outer side of both fingers; fixed finger horizontal in relation to palm; meri of walking legs with large tympana on underside ... ... *T. pusillus.*
            ii. Granules on outer surface of palm not arranged in a reticulate manner; no carinae on outer sides of fingers; fixed finger bent downwards in relation to palm; meri of walking legs without tympana ... *T. philippinensis.*
         b. No notch on lateral border of carapace behind outer orbital angles; 4th and 5th segments of male abdomen fused, distal angles of 4th segment produced and acute. [No carinae on outer sides of fingers; meri of walking legs with conspicuous tympana] ... ... *T. integer.*
      2. Carapace quadrilateral, the orbits being almost or quite transverse; outer surface of palm quite smooth or with very inconspicuous microscopic granules near lower border.
         a. Front narrow, less than one fifth anterior breadth of carapace; a well-defined groove on side-walls of carapace extending from anterior angles of buccal cavern to base of penultimate legs; abdomen of male with 5th segment only a little constricted, 7th broader than long. [Lower surface of palm flattened and bordered by carinae.]
            i. Front not more than one eleventh anterior breadth of carapace; upper surface of carapace not wider at the middle than anteriorly; chela of adult male weak, similar to that of female; male with a patch of tomentum on carpus and propodus of 2nd walking legs *T. stevensi.*
            ii. Front not less than one seventh anterior breadth of carapace; upper surface of carapace wider at the middle than anteriorly; chela of adult male strong, dissimilar to that of female; male without tomentum on 2nd walking legs ... ... *T. frater.*
         b. Front broader, more than one quarter anterior breadth of carapace; groove on side-walls of carapace visible only near angles of buccal cavern; abdomen of male with 5th segment deeply constricted, 7th at least as long as broad.
            i. Anterior breadth of carapace less than $1\frac{1}{2}$ times its length; front angular at sides; crest defining lateral border of carapace discon-

tinuous posteriorly; outer surface of palm without a carina, its upper border rounded *T. stapletoni.*

ii. Anterior breadth of carapace more than 1½ times its length; front rounded; crest defining lateral border of carapace continuous throughout its length; outer surface of palm with a fine carina running to tip of fixed finger, its upper border crested ... *T. deschampsi.*

B. Carpus of cheliped with a tooth on its inner aspect. [Front not less than one quarter anterior breadth of carapace; male abdomen with 5th segment very slightly constricted.]

1. Surface of carapace with numerous small furry patches; carpus of cheliped short, its upper surface about 1½ times as long as broad; palm without carinae on lower surface; fingers with large teeth in male ... . *T. lingulatus.*

2. Surface of carapace without furry patches; carpus of cheliped elongate, its upper surface twice as long as broad; lower surface of palm bounded by fine carinae; fingers without large teeth.

a. Lower border of orbit with a large projecting lobe near its outer end; lateral margin of carapace sinuous ... ... *T. orientalis.*

b. Lower border of orbit without a projecting lobe; lateral margin of carapace regularly convex ... *T. gangeticus.*

II. Eyestalk with a long terminal style projecting far beyond cornea. [Front about one fifth anterior breadth of carapace; orbits oblique; lateral border concave; carpus of cheliped elongate] ... ... *T. ceratophora.*

Koelbel has suggested that *T. ceratophora* should be placed in a separate subgenus, *T. methypocoelis*, but I do not think this necessary.

Of the eleven species I have seen all but *T. philippinensis*, *T. integer* and *T. ceratophora*. *T. stevensi*, *T. frater*, *T. stapletoni*, *T. orientalis*, *T. gangeticus* and *T. lingulatus* are Indian species.

Tympanomerus pusillus (de Haan).

1835. *Ocypode* (*Cleistostoma*) *pusilla*, de Haan, in Siebold's *Faun. Japon., Crust.*, p. 56, pl. xvi, fig. 1.

1852. *Cleistostoma pusilla*, Milne-Edwards, *Ann. Sci. nat., Zool.*, (3) XVIII, p. 160.

1888. *Dioxippe pusilla*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 137.

1889. *Dioxippe pusilla*, de Man, *Zool. Jahrb., Syst.*, IV, p. 447.

1902. *Cleistostoma pusillum*, Doflein, *Abh. math.-phys. Classe K. Bayer Akad.* Wiss. XXI, p. 667.

$\frac{97\,95}{10}$ Japan. J. Anderson (*per* J. G. de Man). Two.

Tympanomerus philippinensis, Rathbun.

1914. *Tympanomerus philippinensis*, Rathbun, *Proc. U.S. Nat. Mus.*, XLVII, p. 84.

Guijulugan, Negros, Philippine Is.

Tympanomerus integer, Tesch.

1918. *Tympanomerus integer*, Tesch, *Decap. Brachyur. 'Siboga' Exped.* I. p. 54, pl. iii, fig. 1.

Kur I., west of Kei Is., Banda Sea.

Tympanomerus stevensi, sp. nov.

Plate XIII, fig. 2.

The carapace is transversely oblong; the anterior breadth is about one and a half times the length and the depth about half the breadth. The upper surface is slightly convex in both directions and is very feebly sculptured. A broad and inconspicuous median furrow extends backwards from the base of the rostrum, disappearing before it reaches the middle of the gastric region and there is a shallow transverse depression on either side some distance behind the orbital border. The posterior limit of the gastric region is defined by a well-marked transverse groove about one third the breadth of the carapace. On the branchial regions there are a few minute tubercles, bearing short setae, arranged in three oblique rows. The two anterior rows are exceedingly short and indistinct and frequently consist of only one or two tubercles each. The most posterior of them is longer and more conspicuous; in direction the row is as much longitudinal as transverse, and if it were continued forwards the line so formed would pass through the front. In this respect a marked difference exists between *T. stevensi* and the closely allied *T. frater*. Posteriorly the carapace is traversed by a sharp and perfectly straight transverse ridge, situated nearer the hinder margin than in *T. stapletoni* and *T. deschampsi*.

The front is obliquely deflexed and at the apex is broadly rounded or with a very obtuse median point; its lateral borders are slightly but distinctly constricted near the base. The breadth of the front is only one eleventh or one twelfth the breadth of the anterior border of the carapace and is thus much narrower than in any other species of the genus.

The orbits are very slightly oblique, much less so than in *T. pusillus*, but not strictly transverse as in *T. stapletoni*. The upper orbital border is microscopically beaded; it is excavate near the base of the front, but in its outer half is almost perfectly straight. The lower border is a little sinuous in dorsal view and is finely crenulate. On the floor of the orbit there is a crest that extends throughout nearly the whole of its length; it runs close to the lower border and the space between the two is hollowed. The outer orbital angle consists of a small acute tooth directed outwards.

The lateral margins of the carapace are very slightly convergent posteriorly and are straight, not convex; the breadth of the upper surface in the middle is thus a little less than its anterior breadth. There is a small emargination or notch behind the outer orbital angles and further back a series of minute denticles. Throughout its length the margin is defined as a sharp crest bearing short setae. At the extreme posterior end, as in *T. pusillus*, it is bifurcated, one branch running to the margin at the base of the penultimate legs, while the other—the more conspicuous of

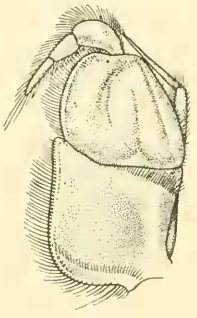
the two—trends inwards in a sinuous curve and terminates in a small angular lobule bearing a tuft of setae, immediately above the base of the last pair of legs.

There are minute tubercles, sparsely distributed, on the anterior part of the side-walls of the carapace. A conspicuous groove runs from the anterior angles of the buccal cavern to the base of the penultimate legs.[1]

The antennules and antennae do not differ appreciably from those of *T. pusillus*, but the epistome is shorter and the broadly triangular median tooth that separates the distal ends of the outer maxillipeds in other species is here exceedingly narrow.

The buccal cavern is nearly one and a half times as broad as long and is completely closed by the external maxillipeds (text-fig. 13). The ischium of the latter appendages is subquadrate with a setose line extending obliquely across it near the anterior border. The merus is a trifle shorter than the ischium and is broader than long. It bears a ∧-shaped furrow anteriorly as in *T. stapletoni*; it is, however, grooved near its inner edge, with the margin reflected upwards and in the proximal half there is a shallow median furrow which runs forward between the terminations of the ∧. The surface of the merus is smooth and shining. The exopod is entirely concealed and is furnished with a long slender flagellum.

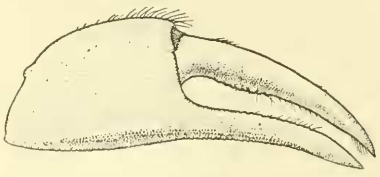
The chelipeds of the male are weak, very little stouter than those of the female, and decidedly less than twice the length of the carapace. The merus is trigonal with microscopically beaded edges; it bears a tympanum internally and sometimes, but not always, another of larger size externally. The carpus is short and smooth without a tooth on its inner aspect; the inner margin of the upper surface is crested and beneath it there is a tuft of very long hairs. The chela (text-fig. 14) is slender, nearly three times as long as the greatest height of the palm and the fingers are more than one and a half times the length of the upper border of the palm. The latter border is crested and microscopically crenulate; parallel with it on the inner face there is a longitudinal row of setae. From the tip of the fixed finger four finely beaded carinae run backwards on to the palm. The two median ridges are parallel and disappear before reaching the middle of the lower surface; the innermost curves obliquely upwards



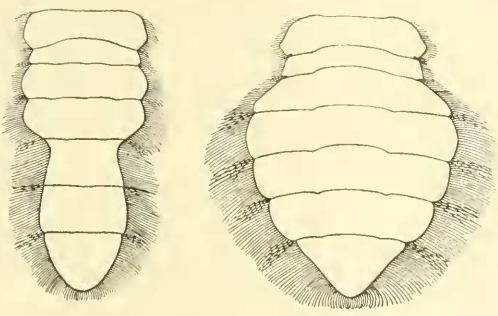
Text-fig. 13.—*Tympanomerus stevensi*, sp. nov. Third maxilliped.

[1] In this respect the species resembles *T. frater*. In *T. pusillus*, *T. stapletoni*, *T. deschampsi*, *T. gangeticus* and *T. orientalis* the groove is inconspicuous and is visible only in the anterior part of its course.

across the inner face, while the outermost runs along the lower part of the outer surface and extends to the proximal end of the palm. Between these ridges there are a few extremely minute tubercles; the remaining portions of the palm, including almost the whole of the outer surface, are quite smooth. The fingers meet only in their distal third when the claw is closed; their tips are curved a little inwards and are slightly spatulate. The fixed finger is without teeth; the dactylus is ridged above and bears a low crest of minute teeth in the proximal half of its prehensile edge.



Text-fig. 14.—*Tympanomerus stevensi*, sp. nov.
Chela of male.



Text-fig. 15.—*Tympanomerus stevensi*, sp. nov.
Abdomen of male (left), of female (right).

In females the chelipeds are a little more slender and the fingers are fully twice the length of the upper border of the palm. The palm is crested above with the row of setae on the inner face as in the male; but on the lower side there are only two carinae, enclosing a flattened lower surface, and each of these carinae bears long setae. The fingers are more distinctly spatulate than in the male; they gape widely at the base and there is no denticulate crest on the dactylus.

The third or penultimate pair of walking legs is the longest, nearly two and a half times the length of the carapace. There are well defined tympana on the upper and lower surfaces of the meri of the first two pairs and on the lower surface of the last two. In the proximal half of the merus of the two intermediate pairs, on the dorsal surface, there is a finely crenulate ridge running parallel to the upper border. The edges of the meri are finely spinulose, a feature specially well marked on the posterior borders of the second and third pairs. In these two pairs the carpus

and propodus each bear two carinae on their superior faces; the dactyli are flattened and in every instance shorter than the propodi. In large males there is a dense patch of tomentum on the second walking legs, extending from the middle of the carpus to the distal third of the propodus; in young males and females no trace of this tomentum can be found. The basal segments of the legs bear long plumose setae which retain fine particles of mud.

The second segment of the abdomen of the male (text-fig. 15) is narrower than the first. The third and fourth are separately rounded at the sides and about as broad as the first, the fourth being a little the longer. The fifth segment is rather more than half the breadth of the fourth and is only slightly constricted near its proximal end; at its narrowest point it is broader than long. The sixth segment is twice as broad as long and is a little wider than the fifth; the seventh is triangular, broader than long and rounded distally. The abdomen of the female (text-fig. 15) is much broader than that of the male but is comparatively narrow at the base; the fourth segment is the broadest; the seventh is triangular in shape and variable in its dimensions.

In the largest male the anterior breadth of the carapace is 7·7 mm., its breadth 5·1 mm. and the breadth of the front about 0·65 mm. In a large female these measurements are respectively 7·0, 4·7 and 0·6 mm.

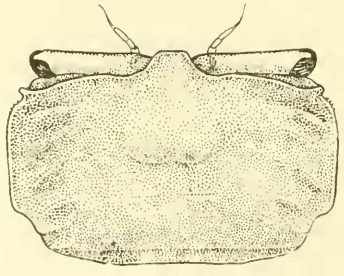
The specimens are of a bluish-grey colour in spirit.

$\frac{9796/7}{10}$ Karachi. C. R. Stevens; March, May, 1917. Twenty-eight.

One of the females is ovigerous. The types bear the number 9796/10. *Zool. Surv. Ind.*

Tympanomerus frater, sp. nov.

This species is very closely allied to the preceding and differs from it only in the following particulars:—



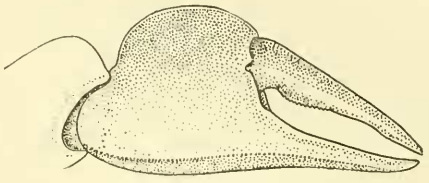
Text-fig. 16.—*Tympanomerus frater*, sp. nov. Carapace.

(i) The carapace (text-fig. 16) is in most respects closely similar to that of *T. stevensi*; but the lateral borders are slightly and evenly convex, with the result that the breadth across the middle is decidedly greater than that between the outer orbital angles.

(ii) The front is very much broader, between one sixth and one seventh the anterior breadth; its lateral borders are a little convergent anteriorly, not constricted as in *T. stevensi*.

(iii) The upper orbital border is decidedly sinuous and is conspicuously concave in its outer half.

(iv) The oblique rows of tubercles on the branchial region are better developed than in the allied form and the most posterior of them is more transverse than longitudinal; if the line formed by this row were continued forwards it would cut the outer end of the orbital border on the opposite side.



Text-fig. 17.—*Tympanomerus frater*, sp. nov. Chela of male.

(v) The chelae of the male (text-fig. 17) are strongly developed, much deeper and longer than those of the female.

(vi) In addition to those mentioned in the description of *T. stevensi* there is a large tympanum on the upper surface of the merus of the penultimate walking legs.

(vii) The borders of the meral segments of the walking legs are microscopically beaded, not spinulose as in the allied species.

(viii) There is no tomentum on the carpus and propodus of the second walking legs of the male.

(ix) A fringe of dark brown bristles, not found in the preceding species, occurs on the edge of the sternum between each pair of walking legs.

(x) The abdomen of the male closely resembles that of *T. stevensi*, but the fifth segment is proportionately a little longer and its sides are more sinuous.

In all other respects the species are in the closest agreement; notably in the presence of a groove extending from the edges of the buccal cavern to the base of the penultimate legs, in the carination of the palm and subspatulate form of the fingers, and in the dorsal carinae on the two intermediate pairs of legs. The two species were, moreover, found together

I was at first of the opinion that two forms of a single species were represented; but the differences, though many of them are small, are too numerous to admit of this possibility. I have been able to separate even the youngest specimens without any great difficulty and have seen adult males and females of both species.

In an adult male of *T. frater* the anterior breadth of the carapace is 5·6 mm., its length 4·0 mm. and the breadth of the front about 0·9 mm. In a female these measurements are respectively 5·0, 3·6 and 0·8 mm. and in another female, which is ovigerous, 5·0, 3·5 and 0·75 mm.

The specimens are of a bluish-grey colour in spirit, sometimes rather darker than *T. stevensi*.

$\frac{9861-2}{10}$ Karachi. C. R. Stevens; March, May, 1917. Twenty-six.

Four of the females are ovigerous. The types bear the number 9861/10, *Zool. Surv. Ind.*

Tympanomerus stapletoni, de Man.

1908. *Tympanomerus stapletoni*, de Man, *Rec. Ind. Mus.* II, p. 212, pl. xviii, figs. 1, 1*a-e*.

This species has been found at a number of additional localities in Bengal and is quite common on the banks of the Hughli river at Calcutta. It is evidently an estuarine form and seems to occur only in places near or a little beyond the limit of tidal influence. At Calcutta the water of the Hughli is frequently quite fresh, but under favourable conditions a slight admixture of salt is to be found up to a point some little distance above the town.

The colour of living specimens agrees in general with de Man's description, but the carapace is frequently of a grey or dull grey-green colour and in the male the fingers of the chelae are orange and the last abdominal segment white.

The species is known only from the Gangetic delta:—

$\frac{5137}{10}$ } $\frac{5851}{10}$ }	Jhalakati, Backergunj dist., Bengal.	H. E. Stapleton.	Many, including Types.[1]
$\frac{9798}{10}$	Kanaigunj, Backergunj dist., Bengal.	,,	Six.
$\frac{9792}{10}$	Banks of Passur R., Khulna, Bengal.	Bengal Fish. Dept. (B. Prashad) and S. Kemp; Oct., 1917; July, 1918.	Forty.
$\frac{9793}{10}$	Banks of Hughli R., near Calcutta. (Sibpur, Shalimar, Budge-Budge and Takta Ghat.)	S. Kemp.	Many.

All the specimens are from small burrows in the mud between tide-marks.

Tympanomerus deschampsi, Rathbun.

1913. *Tympanomerus deschampsi*, Rathbun, *Proc. U.S. Nat. Mus.* XLVI, p. 356, pl. xxxii, pl. xxxiii, fig. 1.

1918. *Tympanomerus deschampsi*, Kemp, *Mem. Asiat. Soc. Bengal* V, p. 228.

$\frac{9432}{10}$ Banks of Whangpoo R., 5-10 miles below Shanghai. N. Annandale. One.

Described by Miss Rathbun from Shanghai.

Tympanomerus lingulatus (Rathbun).

1909. *Cleistostoma lingulatum*, Rathbun, *Proc. Biol. Soc. Washington* XXII, p. 108.

1910. *Cleistostoma lingulatum*, Rathbun, *K. Danske Vidensk. Selsk. Skrift.* (7), *naturvid. og math.*, V, p. 323, text-figs. 7, 8.

This species was described by Miss Rathbun from an immature female found in the Gulf of Siam; two adult males and an ovigerous female have since been obtained by the R.I.M.S. 'Investigator' in the Mergui Archipelago.

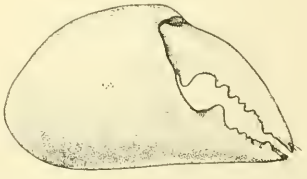
There is, I think, no doubt that the species must be transferred to the genus *Tympanomerus*. The antennular flagella are minute

[1] There seems to have been a mistake about the precise locality of these specimens; on the label sent with them to de Man "Dacca" was certainly written, but information subsequently supplied by the collector showed this to be incorrect.

and rudimentary, lying in small oblique pits close to the edge of the front and separated by a comparatively broad septum, as in *Tympanomerus pusillus* and other Scopimerinae. In the Macrophthalminae, to which the genus *Cleistostoma* belongs, the antennules are well developed, fold quite transversely, and the septum between them is very narrow. These characters constitute, so far as I am aware, the only really valid distinction between the subfamilies Macrophthalminae and Scopimerinae, for the tympana found in most species of the latter subfamily are ill-defined and occasionally absent in *Tympanomerus*. On comparing *T. lingulatus* with Alcock's *Cleistostoma dotilliforme* the differences in the antennules are quite evident.

The Mergui specimens of *T. lingulatus* agree very closely with Miss Rathbun's description, but her figure does not altogether succeed in conveying the characteristic appearance of the upper surface of the carapace. In the individuals I have seen the majority of the fine granules are aggregated into small clusters, varying a little in size and arrangement and each set with short dark brown bristles retaining mud. The carapace in specimens which have not been cleaned overmuch is, in consequence, seen to be covered with small furry patches, rather than with isolated granules as in Miss Rathbun's figure. The angle on the lateral margin of the carapace in front of its middle point is in reality more obtuse than in the figure, but it bears a setiferous patch which makes it look more prominent. The oval cavities above the edge of the front are very evident, the species differing in this character from any other known species of *Tympanomerus*. The prominent median tooth on the epistome is paralleled in *T. stevensi* and *T. frater*.

The chelipeds of the male are short. The carpus bears a strong tooth on its inner side as in *T. gangeticus* and *T. orientalis*; it is, however, much shorter than in those species, its upper surface being only about one and a half times as long as broad. Above the tooth on the inner side there are some long setae, while on the upper surface there are some short brown bristles. The palm is swollen and its height is fully as great as the length of the upper border (text-fig. 18). The outer side is smooth and convex; inferiorly it is rounded, without any traces of the longitudinal keels found in many species of the genus. The upper surface is finely granular with scattered setae. On the inner side there is a huge blunt ridge which commences near the posterior end of the upper border and curves downwards and forwards to the base of the fixed finger. The summit of the ridge is irregularly tuberculate and, in the area between it and the finger-cleft, there is a patch of long hairs.

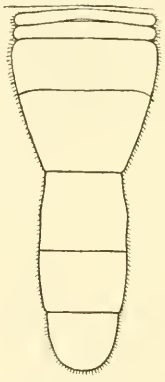


Text-fig. 18.—*Tympanomerus lingulatus* (Rathbun).
Chela of male.

The fingers are longer than the upper border of the palm and meet only at the apices where they are provided with corneous tips and some setae. The dactylus is strongly curved; it bears a large tooth close to the base and another, not quite so large, near the apex; between the two there are some smaller teeth. The dentition of the fixed finger is similar, the teeth being in advance of those on the dactylus; the proximal tooth is very large and conical. In the ovigerous female the chelipeds are as shown in Miss Rathbun's figure; the carpus, however, bears a small acute tooth on its inner side.

The meral segments of the walking legs bear thickly setose patches, resembling tubercles, as described by Miss Rathbun. In addition, the upper surfaces of the meri, carpi and propodi are rather closely covered with brownish hair in males, while in the same sex on the underside of each merus there is a thickly felted patch.

In the abdomen of the male (text-fig. 19) the suture between the third and fourth segments is exceedingly fine and inconspicuous, suggesting that the segments are not separably movable. The first and second segments are very short, and, though broad, do not nearly fill all the space between the last two pairs of legs. The second and third segments taken together are a little longer than broad with gently curved sides that converge strongly anteriorly. The fifth segment is about as long as its distal breadth, much narrower than the base of the third, and is very inconspicuously contracted at its proximal end. The sixth is broader than long and the seventh about as long as broad, with a broadly rounded apex.



Text-fig. 19.—*Tympanomerus lingulatus* (Rathbun). Abdomen of male.

In the larger of the two males the greatest breadth of the carapace is 5·4 mm., its anterior breadth 4·8 mm. and its length about 4 0 mm. In the ovigerous female the greatest breadth is 5·2 mm.

T. lingulatus appears to find its nearest allies in *T. orientalis* (de Man) and *T. gangeticus*, sp. nov., agreeing with these species in the possession of a strong tooth at the inner angle of the wrist.

$\frac{9749}{10}$	Trotter I., Mergui Archipelago.	'Investigator.'	Two males.
$\frac{9800}{10}$	Jack and Una Is., Mergui Archipelago.	,,	One female.

The specimens were found in November 1913 on a shore composed of mud and sand with larger boulders. That described

by Miss Rathbun is from a mangrove swamp at Lem Ngob in the Gulf of Siam.

Tympanomerus orientalis (de Man).

1888. *Dioxippe orientalis*, de Man, *Journ. Linn. Soc., Zool.*, XXII, p. 138, pl. ix, figs. 8-10.
1900. *Tympanomerus orientalis*, Alcock, *Journ. Asiat. Soc. Bengal* LXIX, p. 371.

$\frac{8}{6}\frac{1}{1}\frac{1}{9}$ Mergui Archipelago. Mus. Collr. Seven. PARATYPES.

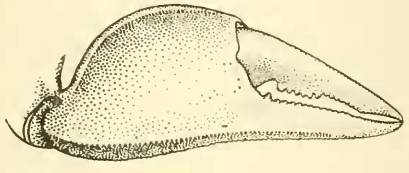
Not known from any other locality.

Tympanomerus gangeticus, sp. nov.

Plate XIII, fig. 3.

This species, which is represented only by two specimens one of which is imperfect, is very closely allied to de Man's *Tympanomerus orientalis*, resembling that species in the possession of a strong tooth on the inner face of the carpus of the chelipedes.

T. gangeticus differs from *T. orientalis* in only two conspicuous features:—(i) the lower border of the orbit shows no trace of the large obtuse lobe found near the outer end in de Man's species; (ii) the crest defining the lateral borders of the upper surface of the carapace is regularly convex behind the small anterior excavation, the upper surface being widest in front of the middle point. In *T. orientalis* the crest takes a sinuous course; it is distinctly concave anteriorly and is obtusely angled behind the middle, the upper surface being widest at this point.

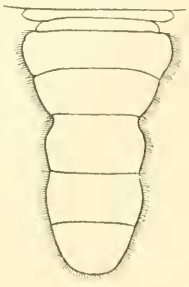


TEXT-FIG. 20.—*Tympanomerus gangeticus*, sp. nov.
Chela of male.

In other respects the differences are small The front is a little broader, with its lateral angles more broadly rounded and its sides more oblique; its apex does not possess a median point. The median groove on the upper surface is deeper and the front when viewed from above is more conspicuously emarginate distally. There are numerous scattered setae on the lateral parts of the upper surface of the carapace. The buccal cavern is broader and the merus of the external maxillipeds is as broad as long (in *T. orientalis* it is longer than broad). The surface of the merus bears numerous very short setae.

The chelipeds are a little shorter: the length of the chela is considerably less than the anterior breadth of the carapace. The upper surface of the carpus is finely roughened and bears numerous minute granules antero-externally. The walking legs are a little shorter and stouter; the merus of the penultimate pair is less than two and three quarter times as long as wide, whereas in specimens

of *T. orientalis* of similar size it is rather more than three times. The carpi and propodi of the first two walking legs are thickly coated with short woolly hair.



Text-fig. 21.—*Tympanomerus gangeticus*, sp. nov. Abdomen of male.

The excavation in the lateral margin of the fifth abdominal segment of the male (text-fig. 21) is a little shallower and the distal parts of the same margin are less convergent anteriorly than in *T. orientalis*.

The carapace of the type male is 4·0 mm. in length and 5·3 mm. in anterior breadth. In life it was uniformly grey in colour, with white fingers to the chelae and with dark spots on the merus, carpus and propodus of the walking legs.

$\frac{97\,94}{1\,0}$	Kaikal Maree, near junction of Matlah and Biddah Rs., Gangetic delta.	S. Kemp; Dec., 1916.	One. Type.
$\frac{98\,08}{1\,0}$	Matlah R., opposite Port Canning, Gangetic delta.	Bengal Fish. Dept. (B. Prashad); March, 1918.	One.

The water in both these localities probably contains some admixture of salt at all seasons. The specimens were found on banks of soft mud between tide-marks and the specific gravity of the water in the locality where the type specimen was taken was 1·0105 (corrected).

Tympanomerus ceratophora (Koelbel).

1898. *Dioxippe ceratophora*, Koelbel, in *Wiss. Ergebn. Reise Grafen Béla Széchenyi in Ostasien* II, p. 573, pl. i, figs. 8-12.

1918. *Tympanomerus ceratophora*, Tesch, *Decap. Brachyur. 'Siboga' Exped.* I, p. 50, pl. 2, fig. 2.

Hongkong (Koelbel); River near Pidjot, Lombok (Tesch).